School Bus Safety Study – Kadyn's Law

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16. Abstract

In 2012, the Iowa legislature passed a bill for an act relating to school bus safety, including providing penalties for failure to obey school bus warning lamps and stop signal arms, providing for a school bus safety study and administrative remedies, and making an appropriation. The bill, referred to as Iowa Senate File (SF) 2218 or "Kadyn's Law," became effective March 16, 2012. A multiagency committee addressed three specific safety study elements of Kadyn's Law as follows:

- Use of cameras mounted on school buses to enhance the safety of children riding the buses and aid in enforcement of motor vehicle laws pertaining to stop-arm violations
- Feasibility of requiring school children to be picked up and dropped off on the side of the road on which their home is located
- Inclusion of school bus safety as a priority in driver training curriculum

This report summarizes the findings for each of these topics.

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SCHOOL BUS SAFETY STUDY - KADYN'S LAW

Final Report
December 2012

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The authors would also like to acknowledge the Federal Highway Administration for state planning and research funding for this project.

EXECUTIVE SUMMARY

As a result of the March 2012 passage of Kadyn's Law in Iowa, this project addressed several specific safety study elements:

- Use of cameras mounted on school buses to enhance the safety of children riding the buses and aid in enforcement of motor vehicle laws pertaining to stop-arm violations
- Feasibility of requiring school children to be picked up and dropped off on the side of the road on which their home is located
- Inclusion of school bus safety as a priority in driver training curriculum

Concluding remarks per study element are noted below.

Do Cameras Reduce Stop-Arm Violations?

Stop-arm cameras by themselves are of little value without a supporting process that results in violations for those who break the law. The technology needed to record and process violations varies. However, the technology is becoming much easier to acquire, given that many school districts have already equipped their buses with internal cameras and, therefore, adding an additional camera for stop-arm violations is a logical next step.

Twenty Iowa school districts confirmed they are using stop-arm cameras as a deterrent. Districts ranged from one or two cameras up to 56 cameras (one for every route bus used) within a specific district.

Although some district personnel felt it was too early to tell, most commented that the stop-arm cameras are considered to be effective and assist in verifying violations. Although the literature search did not provide a detailed field evaluation on the effectiveness of using cameras as a deterrent, other studies did document the effectiveness of other bus strategies (to increase awareness).

Stop-arm cameras do aid in enforcement of motor vehicle laws and enhance safety if there is an effective and sustainable process to turn camera images into violations. Whether or not Iowa school districts currently have an effective and sustainable process to rely on is up for debate. Currently, they do. However, as more cameras are added each day, they probably do not.

Processing violators is a laborious task for all parties involved. It is currently up to the school bus driver to note each stop-arm violation. The school district must then isolate the images and provide this to the local law enforcement agency. Law enforcement then has to verify and deliver the violation to the motorist.

As noted in this report, North Carolina went through a decade of increased penalties and fines for stop-arm violations, yet little progress was made until they enacted a law that allowed for automation and third-party involvement.

If the stop-arm violation rates are even close to that reported by the National Association of State Directors of Pupil Transportation Services (NASDPTS)—with 100,000 bus drivers reporting that 88,025 vehicles passed their buses illegally on a single day—the addition of stop-arm cameras on a fraction of the school buses in Iowa could swamp the school district and law enforcement agency abilities to prosecute these dangerous violations.

As with any new law, some enhanced judicial outreach will help to align convictions with the revised penalties. Given that the law was enacted in March, a review of the "failure to stop for a school bus" convictions between August 15 and October 31 showed that even though Kadyn's Law requires a minimum fine of $250 for the first offense, 105 of the 162 convictions (65 percent) had a fine amount of less than $250.

Thinking forward, the research team suggests that consideration be given to modifying the current Iowa model and penalties to be more aligned with the administrative model commonly used for red light running:

Red light running cameras typically work in the following way. The city either purchases the cameras or leases the cameras from a vendor. In most cases, the city uses the vendor to preview violations. The vendor identifies and removes red light running events that are not enforceable, such as an emergency vehicle passing through the intersection. The vendor also removes events where the system was not functioning or it cannot be determined if red light running occurred. The vendor then forwards potential red light running violations to the city enforcement office, where officers review the events and then issue citations.

The majority of camera systems in the US take only a snapshot or video showing the forward and/or rear license plate. As a result, the ticket is a civil penalty similar to a parking ticket, which is issued to the owner of the vehicle. As a result, the driver does not receive a moving violation, and the fines for red light running, which vary by jurisdiction, range from $65 to $195 in Iowa. To target the driver, the camera system would need to take a snapshot of the driver's face and this has proved too controversial for cities to address.

Enhancing child safety by reducing the frequency of stop-arm violations begins with swift and effective enforcement. Enforcement should not be limited by bus driver capabilities or the time restraints of each school district or law enforcement agency. A forward-looking model would provide flexibility for smaller districts to work with law enforcement to process violations manually and at the same time allow larger districts the option of third-party involvement to assist with higher numbers of violations and vigorous compliance with the law.

Feasibility of Requiring Home-Side Loading

As a general rule, the research team found that many school districts use home-side loading when possible and are conscientious about every stop made where children must cross the street to load or unload from the bus.

In an effort to evaluate the impact of requiring home-side loading for all stops, the research team worked with a school district to evaluate both an urban and rural route scenario. The existing bus routes were revised to comply with home-side loading and a comparison was made in terms of number of student stops, distance traveled, and student ride time.

The results show that requiring home-side loading for all stops has dramatic effects on routing efficiency (33 more student stops on the urban route and 17 more miles of travel on the rural route) and considerable cost impacts. At a minimum, this requirement resulted in more than $8,000 and $24,000 in additional annual costs for the single urban and rural routes, respectively. At the district level, this had an impact on the district operating costs by a factor of 1.6.

Although a more detailed evaluation across multiple districts study could refine these estimates, home-side loading has the potential to affect the cost per pupil transported significantly without a defined quantifiable benefit to justify these costs.

Looking forward, districts should continue to be encouraged to consider home-side loading as a matter of best practice and discretion and stop short of a specific requirement. The decisions made regarding every bus stop and route should be derived, reviewed, and modified using the local knowledge and resources from the district.

Driver Training Curriculum

Based on review of other state driver manual content, the researchers noted several illustrations that could possibly be used to improve driver comprehension of school bus stop requirements. However, no research has been done to verify the public's understanding or opinion of the illustrations. Including similar illustrations in driver training manuals are suggested as best practices based on the expert opinion of the researchers.

INTRODUCTION

In 2012, the Iowa legislature passed a bill for an act relating to school bus safety, including providing penalties for failure to obey school bus warning lamps and stop signal arms, providing for a school bus safety study and administrative remedies, and making an appropriation. The bill, referred to as Iowa Senate File (SF) 2218 or "Kadyn's Law," became effective March 16, 2012.

A multiagency committee requested assistance from a team comprised of researchers from both Iowa State University and the University of Iowa in addressing the safety study elements of Kadyn's Law as follows:

"…The study shall focus on the use of cameras mounted on school buses to enhance the safety of children riding the buses and to aid in enforcement of motor vehicle laws pertaining to school bus safety. The study shall also consider the feasibility of requiring school children to be picked up and dropped off on the side of the road on which their home is located, and the inclusion of school bus safety as a priority in driver training curriculum, and any other issues deemed appropriate by the departments. The findings and recommendations shall be reported to the general assembly by December 31, 2012."

Objective

Results from this study will assist the Iowa Department of Transportation/Department of Education/Department of Public Safety (DOT/DOE/DPS) in addressing the goals and safety study elements placed within Kadyn's Law.

Scope

The project scope addressed several specific safety study elements as follows:

- Use of cameras mounted on school buses to enhance the safety of children riding the buses and aid in enforcement of motor vehicle laws pertaining to stop-arm violations
- Feasibility of requiring school children to be picked up and dropped off on the side of the road on which their home is located
- Inclusion of school bus safety as a priority in driver training curriculum

ISSUE PERSPECTIVE

National Survey on Illegal Passing of School Buses

In August 2012, the National Association of State Directors of Pupil Transportation Services (NASDPTS) provided a press release on the results of its second annual survey on illegal passing of school buses, which aptly characterizes the challenges faced as follows (NASDPTS 2012):

In 28 states throughout the country, about 20 percent of the nation's school bus drivers participated in a one-day survey to report how many times motorists passed their stopped school buses illegally. Nearly 100,000 bus drivers reported that 88,025 vehicles passed their buses illegally on a single day. Throughout a 180 day school year, these sample results alone point to nearly 16 million violations by private motorists.

"There are over 480,000 school buses on the road each day in the United States," said Mike Simmons, president of the NASDPTS. Simmons added, "This survey captured only a fraction of the violations that bus drivers and other professionals in school transportation and law enforcement know are occurring each and every morning and afternoon. Students are far safer in school buses than the other ways they get to school, but when they are outside the bus, they are the most vulnerable. Any driver who passes a stopped school bus illegally is gambling with a child's life."

NASDPTS first coordinated the survey in 2011, and this year's results are unfortunately consistent. In 2011, 76,685 motorists illegally passed buses during the one-day survey. NASDPTS encourages state directors, local school districts, law enforcement agencies, legislators, citizens, and all motorists to use these disturbing results to help solve this ongoing threat to the safety of students. The association believes these results should trigger more safety countermeasures within states and at the national level, including greater motorist awareness, greater enforcement, and tougher, more-uniform laws.

Many of these violations included multiple violations at one stop, as there were only 39,760 passing incidents. In addition, 98 percent of stop-arm violations pass the bus on the left side with 62 percent approaching from the front and 38 percent from the rear of the bus. Although this may seem like a significant number of violations, it is impossible to know how representative this number is in terms of exposure rate (given we don't know how many times each school bus stops nor how many other vehicles it encounters during those stops). Without this denominator term, it is impossible to calculate a rate of stop-arm violations.

Additional research is needed to determine the true level of exposure. This would entail having researchers count not only the vehicles that pass a stopped bus with the stop arm extended while loading/unloading children, but also the number of cars that are present and do not pass the bus at those times.

Bus Safety

School buses provide school-aged children with one of the safest forms of transportation available (Yang et al. 2009). The Transportation Research Board (TRB) conducted a study to assess the relative risks of school travel. The authors examined nine years of motor vehicle crashes nationally for school-aged children during normal school hours and found that only 2 percent of fatalities occurred on school buses (NRC 2002). The majority of fatalities occur in private passenger vehicles or as pedestrians or bicyclists. The next largest category of fatalities and injuries involve students walking or biking.

More recently, the National Highway Traffic Safety Administration (NHTSA) reported 1,386 school transportation-related fatalities between 2000 and 2009. Of those fatalities, 107 were occupants of the bus, 238 were struck by either the bus or another vehicle, and the remaining 1,041 were occupants of other vehicles (NHTSA 2011).

With such relatively low rates of fatality in comparison with other travel modes, parents should be encouraged to have their children ride the bus to and from school. Yet, despite being one of the safest modes of transportation, school bus injury is still a concern, as many children are hit either by the bus itself or by other motor vehicles when loading and unloading the bus. The TRB found that 50 percent of children killed annually in school related crashes are struck by the bus while pedestrians and 25 percent are struck as pedestrians by other vehicles, many of which pass the school bus illegally while it is loading or unloading (NRC 2002).

The act of illegally passing a stopped school bus with red lights flashing is called a stop-arm violation (NHTSA 2012). Some additional national statistics on the magnitude of the problem are as follows:

- The Florida Department of Education asked school bus drivers to record stop-arm violations for one day in May 1995 and 2000. These school bus drivers recorded 10,590 and 10,719 stop-arm violations on those days, respectively. During the 1995 study, 11,150 school buses were in daily operation, which equates to an average of almost one illegal pass per school bus that day (0.95). In 2000, this ratio was 0.76 stop-arm violations per school bus operated in daily service. To get an idea of the magnitude of the problem statewide, multiply the number of stop-arm violations recorded during the one-day May 2000 field study (10,719) by the number of school days in a typical school year (180). This calculation predicts that nearly 1.92 million stop-arm violations will occur in a typical school year in Florida (Florida DOT 2000).

- A one-day study in Virginia in 1996 found that 3,394 drivers illegally passed a stopped school bus and nearly six percent were right-side passes.

- The Illinois Department of Transportation surveyed 135 school bus drivers who reported an average of 84 stop-arm violations per day.

Turner and Stanley (2008) conducted a survey of bus drivers in 761 public and charter schools in Texas. Drivers recorded vehicles that illegally passed school buses while stopped with the red loading lights activated. The bus drivers reported 12,850 stop-arm violations during the one-day study. An evaluation of the violations found no pattern by time of day with violations being roughly split between morning (47 percent) and afternoon (53 percent).

The majority of violations (58 percent) resulted from drivers approaching the bus (on-coming). The majority of drivers passed the buses on the left; however, 11 percent passed on the right. The majority also occurred on two-lane roadways (53 percent) and 13 percent occurred on four-lane divided roadways. Depending on the school district, an average of 1.7 to 7.8 violations per bus occurred during the study day.

Scope of the Stop-Arm Violation Problem in Iowa

Prior to this study, no information has been gathered about the magnitude of stop-arm violations in Iowa. The Iowa DOT crash database was reviewed to determine whether stop-arm violation crashes could be identified and extracted. The review found it would be very difficult given there is no field on the current crash form to indicate such a crash.

The first attempt by the researchers was to identify child pedestrian crashes during school hours and then to use other crash characteristics to determine if the crash involved a vehicle going around a stopped school bus. However, uninvolved vehicles are not coded in the crash database so a crash involving a vehicle passing a stopped school bus would not actually include a school bus as one of the vehicles unless another vehicle actually struck the bus.

Although it was not possible to identify stop-arm crashes specifically, the team worked with the Iowa DOT to identify fatal child pedestrian crashes during school times. A total of 29 fatal crashes were identified from 2002 through 2011, which included child pedestrians (17 years of age and younger) occurring during school months (September through May). The crash narrative and description for each fatal crash were then reviewed to determine whether the event involved a stop-arm violation. As illustrated in Figure 1, narratives from the 29 fatal child pedestrian crashes in Iowa from 2002 through 2011 identified the following:

- One crash was identified as a stop-arm violation
- Two crashes occurred with school buses as follows:
  - A child pedestrian exited the school bus and crossed the roadway and, as the bus was departing, the child ran back across the road in front of the bus, presumably to retrieve an article left on the bus
  - A child pedestrian was struck by the bus but no additional information was provided except that icy conditions existed
- In the other 26 cases, the child pedestrian ran into street and was struck by a vehicle, the vehicle left the roadway or violated a traffic control and struck the child pedestrian, or the vehicle backed over the child pedestrian

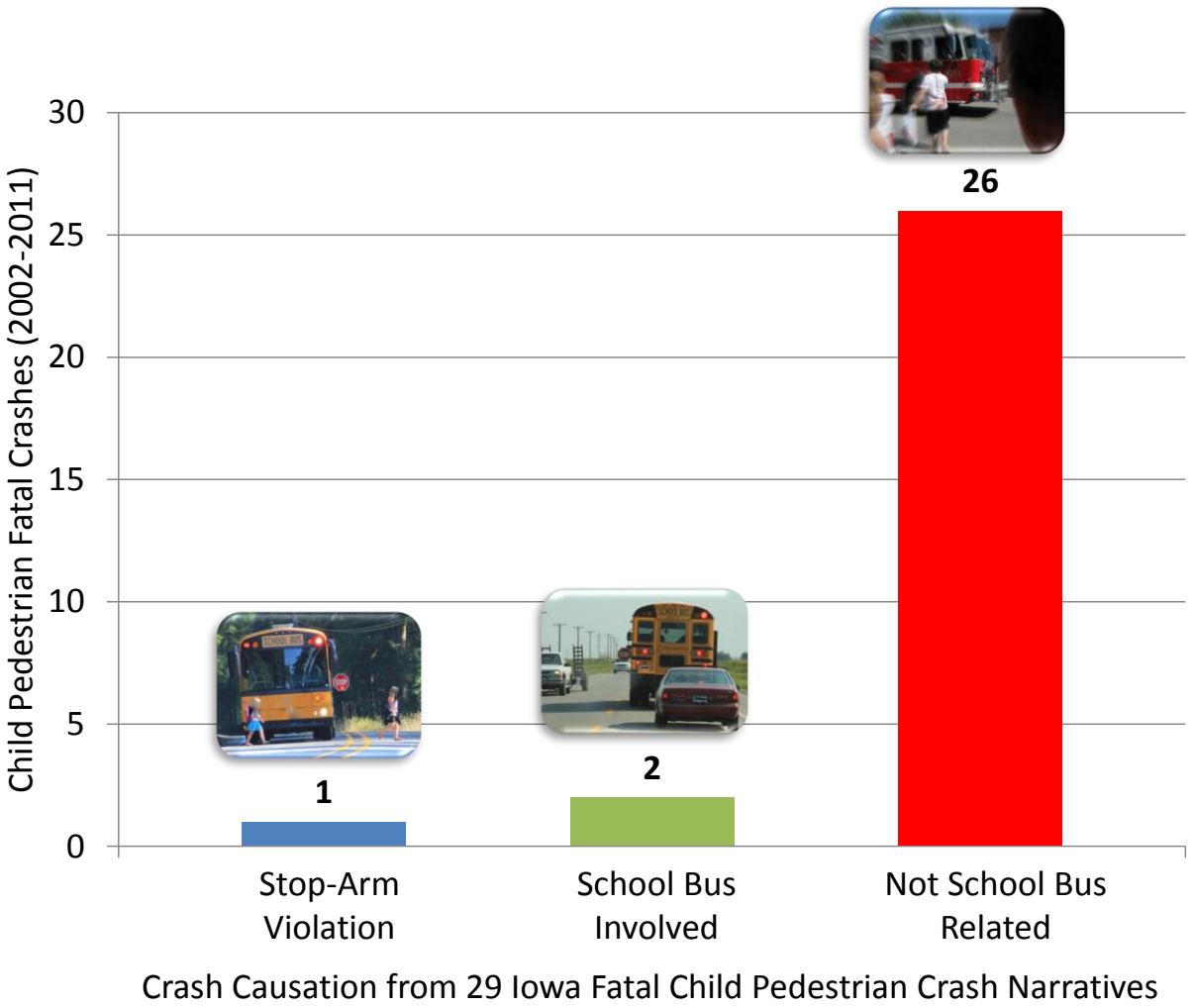


Figure 1. Fatal child pedestrian crash causation in Iowa 2002-2011

Bus Danger Zone

The loading and unloading area around a bus where children are in the most danger of not being seen by a driver is called the Danger Zone. The area is 10 feet in front of the bus, 10 feet on either side of the bus, and behind the school bus (Iowa DOT 2004) as shown in **Error! Reference source not found.**. As mentioned previously, the act of illegally passing a stopped school bus with red lights flashing is called a stop-arm violation (NHTSA 2012).

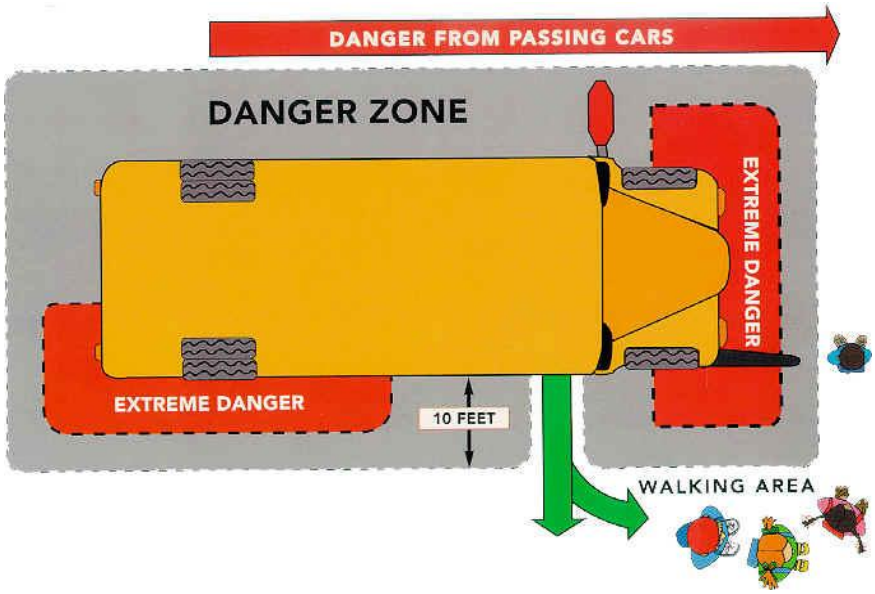


Figure 2. School bus danger zone (Rockford Public Schools - Department of Transportation)

Addressing Stop-Arm Violations

NHTSA (2012) discusses several issues to consider to fully address stop-arm violations:

- The law is not obeyed because drivers do not know what the law is or do not understand the safety risks or penalties for breaking the law
- Drivers do not have enough sight distance to see and stop for the bus due to a curve, hill, or overgrown vegetation
- Bus drivers may not be certain of the specifics of stop-arm laws and may not report violations accurately and/or they may be unsure how to report them
- Bus drivers may be reluctant to report stop-arm violations if they perceive it will have little impact
- Lack of reporting makes it difficult to establish a baseline so the problem can be addressed

Solutions to address stop-arm violations involve education, policy, modifications to the school buses themselves, and bus routing (NHTSA 2012).

Enforcement and Education

Additional enforcement and public information campaigns have been widely used to reduce stop-arm violations. Officers target problem areas or ride along with or follow school buses on occasion. In one state, school bus drivers can file an arrest warrant if they can identify the driver properly (NHTSA 2012). Other examples of enforcement and education include the following (NHTSA 2012):

- Selective traffic enforcement programs use periods of increased enforcement to reinforce driver behavior and these are often conducted at the beginning of the school year to remind drivers that school is back in session
- Officers follow or ride a particular school bus
- Stop-arm violation enforcement is combined with other special enforcement activities such as speed enforcement
- Connecticut does an operation "Safe Stop" day where officers target trouble spots and, each year this was done, a survey that was conducted one month before and then on "Safe Stop" day found that violations were up to 34 percent lower
- The Florida Department of Education established a toll-free line for citizens to report stop-arm violations and, although no ticket can be issued unless witnessed by law enforcement, a warning letter and information is sent to violators
- School bus drivers in New York complete a report that is sent to the Department of Motor Vehicles, which sends a letter to the motorist informing them of the violation and reminding them of the law
- New York conducts an annual one-day blitz with officers riding buses and police cars following buses and patrolling hot spots
- In Tennessee, school bus drivers can file an arrest warrant if they can identify the driver properly
- In Will County, Illinois, police cars were equipped with radio frequencies for bus garages so they can respond to stop-arm violations and they also use stationary patrols in unmarked cars

Perhaps the greatest aid in reducing fatalities and injuries related to stop-arm violations does not reside in reform of state law, but in education of school-aged children in pedestrian and bus safety. Many training programs, such as video programs, are in effect to teach children (Hotz et al. 2004) and street-side training initiatives (Demetre 1993). Virtual reality is also being tested to this end (Schwebel and McClure 2010). Many schools have pedestrian safety training in place and integrating an embarking/disembarking safety training component should be considered.

Additional enforcement and public information campaigns have also been widely used to reduce stop-arm violations. Officers target problem areas or ride along with or follow school buses on occasion. In one state, school bus drivers can file an arrest warrant if they can identify the driver properly. In one community, officers will not just give warnings for stop-arm violations (NHTSA 2012).

Bus Modifications and Other Strategies

The wording and signage on the rear of buses can be changed to reinforce the law as shown in Figure 3 in Missouri and Figure 4 in Washington. Pulaski County, Arkansas uses two stop arms on the left and one on the right. Several areas use additional stop-arms on the driver side near the rear of the bus as shown in Figure 5 in Buffalo, New York. Some transit agencies, particularly in Europe, use electronic illuminated signs on the rear of bus that depict pedestrians as shown in Figure 6 in Paris, France.

Figure 3. School bus in Missouri with specific text warning on back door (D. McGhee 2012)

Figure 4. School bus in Washington with sign on back bumper (N. Hawkins 2012)

Figure 5. School bus in Buffalo, New York with additional rear stop arm (N. Hawkins 2012)

Figure 6. Transit bus with electronic sign display for loading and unloading in Paris, France (S. Chrysler 2011)

Roadway signage has also been changed. A school district in Florida used variable message roadside signs that were placed in problem areas. The signs displayed messages about not passing stopped buses (NHTSA 2012).

In Minnesota, several locations have installed dynamic school bus stop warning signs that are activated only when school buses are present (U of M LTAP 2011). This approach requires intelligent transportation system communications technology such as radio frequency identification (RFID) tags or radio communication between the bus and the sign controller.

None of the jurisdictions noted above have provided safety benefit studies for use of these technologies.

Bus Routing

Careful routing of school buses is yet another way to mitigate injury and fatality caused by stop-arm violations. In 2010, NHTSA released a set of guidelines to be cognizant of when creating routes for school buses. Some of the important considerations include same-side stops, visibility, student distance from the road and traffic, and avoiding multi-lane roads whenever possible (Turner and Stanley 2008).

Sight distance should also be considered because drivers in some cases may not be able to see the bus and stop in time. NHTSA (2012) indicates some schools have analyzed bus routes with higher than normal number of stop-arm violations to assess where sight distance is an issue.

Stop-Arm Cameras

Within the US, many school districts have equipped their route buses with video cameras, digital video recorders, and/or audio recording capabilities to monitor and deter problematic behavior within the bus. In addition, districts are adding cameras to view the outside of the bus to, again, deter problematic behavior (drivers who illegally pass a stopped school bus when the stop arm is deployed and the lights are flashing) and hold violators accountable.

Stop-arm violations are triggered either manually (when the school bus driver records the vehicle license plate number out loud or completes other actions to time-mark the video) or automatically (when cameras capture high-definition video and images of license plates and drivers based on automatic triggers).

In Iowa, violations must be reported by a person, not a camera. Hence, the school bus driver typically reports the violation, the school district extracts the video and images, and the appropriate law enforcement agency is left to process the violation.

The recent passage of Kadyn's Law has stiffened the penalties for stop-arm violations in Iowa. In comparison, North Carolina's legislature also passed successive bills that increased penalties and

closed loopholes on school stop-arm violations over a 10 year period. In 2009, North Carolina House Bill 440 (the "Nicholas Adkins School Bus Safety Act," passed in memory of a 16 year old student killed when a driver did not stop for a stopped school bus) added a critical provision to an existing law, allowing the use of automated camera and video recording systems to detect and prosecute violators (NC School Bus Safety 2012).

In addition to North Carolina, a number of states have enacted laws allowing use of automated cameras that are installed on the bus exterior as shown in Figure 7.

Figure 7. Stop-arm violation camera (Gatekeeper Systems Inc.)

Most systems can be described as having cameras that can capture still images or video and may include a global positioning system (GPS), which can record the location of the violation (ATS 2012). The system may also include infrared illumination for low light conditions (GSI 2012). Violation information is sent for review by law enforcement personnel for approval. If approved, a citation is issued to the vehicle owner (ATS 2012).

As of December 2011, seven states have introduced legislation allowing stop-arm violation cameras (Townsend 2011).

Kadyn's Law in Iowa

The March 2012 passing of Kadyn's Law has stiffened the penalties for stop-arm violations in Iowa. Prior to the enactment of Kadyn's Law, the fine for stop-arm violations was $200. Now, as shown in Table 1, a graduated penalty system is in place with a minimum fine of $250.

Table 1. Fines for unlawful passing of a school bus per Kadyn's Law

Offense	Criminal citation	Fine (additional surcharges and court costs apply)	Imprisonment	Driving Privilege Suspension
First offense	Iowa Code 321.372(5)(b)(1) — Unlawful passing of school bus first offense, simple misdemeanor	Iowa Code 321.372(5)(b)(1) — At least $250, but not more than $675	The court may order imprisonment not to exceed 30 days in lieu of or in addition to a fine.	The Iowa DOT will impose a 30-day suspension.
Second offense	Iowa Code 321.372(5)(b)(2) — Unlawful passing of school bus, second or subsequent offense, serious misdemeanor	Iowa Code 903.1(b) — At least $315, but not more than $1,875	The court may also order imprisonment not to exceed one year.	The Iowa DOT will impose a 90-day suspension.
Third and subsequent offenses	Iowa Code 321.372(5)(b)(2) — Unlawful passing of school bus, second or subsequent offense, serious misdemeanor	Iowa Code 903.1(b) — At least $315, but not more than $1,875	The court may also order imprisonment not to exceed one year.	The Iowa DOT will impose a 180-day suspension.
Any offense causing serious injury to another person*	Iowa Code 321.482A — Violations resulting in injury or death — additional penalties	Iowa Code 321.482A(1) — a fine of $500	N/A	The court may order the Iowa DOT to suspend the person's driving privileges for a period of 90 days in lieu of or in addition to the fine.
Any offense causing death to another person* **	Iowa Code 321.482A — Violations resulting in injury or death — additional penalties	Iowa Code 321.482A(2) — a fine of $1,000	N/A	The court may order the Iowa DOT to suspend the person's driving privileges for a period of 180 days in lieu of or in addition to the fine.

Although misdemeanor convictions do not pose the same penalties as felony convictions, they often have other effects on a person's life. Employers often run background checks and, when they do, a misdemeanor is a criminal offense that will appear on the report. A misdemeanor can also cause problems with obtaining security clearances.

As with any new law, some enhanced judicial outreach will help to align convictions with the revised penalties. Given that the law was enacted in March, a review of the "failure to stop for a school bus" convictions between August 15 and October 31 showed that even though Kadyn's Law requires a minimum fine of $250 for the first offense, 105 of the total 162 convictions (65 percent) had a fine amount of less than $250 (Driver Services Research and Driver Safety Data Analysis 2012). A summary for the 162 convictions by fine category is as follows:

- In one case, the judge made it a $60 civil penalty with no court costs or surcharge
- In one case, the judge will dismiss the charge if the defendant will do some community service
- One conviction was from out of state so the fine amount is unavailable
- In four cases, the judge required the defendant to pay $60 court costs only
- In 19 cases, the judge set the fine at $65, which is the minimum fine for a non-scheduled simple misdemeanor
- In 19 cases, the judge set the fine at $100, which is half of what the scheduled fine was for this violation prior to the implementation of Kadyn's Law
- In two cases, the judge set a $150 fine
- In 60 cases, the fine was set at $200
- In 55 cases the fines ranged from $250 to $500

USING CAMERAS TO ADDRESS STOP-ARM VIOLATIONS IN IOWA

One objective of this study was to identify how stop-arm cameras enhance the safety of children riding buses and aid in enforcement of motor vehicle laws pertaining to school bus safety. This objective was addressed through survey and follow-up discussions with Iowa school district transportation staff, law enforcement, and departments of transportation, education, and public safety staff.

In-State Experiences

The research team conducted an electronic survey of all Iowa school districts that yielded 176 district responses. A portion of the survey asked the districts about their use of video in deterring stop-arm violations as noted below.

Use of Video Cameras for Stop-Arm Detection in Iowa

Table 2 shows that, out of 125 responses, 16 percent are currently using video cameras as a deterrent for stop-arm violations.

Table 2. Survey results for Iowa on using video cameras to deter stop-arm violations

Q. Are externally mounted video cameras used within your district to deter stop arm violations?		
Answer Options	Response Percent	Response Count
Yes	16%	20
No	84%	105
answered question		*125*
skipped question		*51*

Number of Buses Equipped with Cameras

Table 3 shows that, out of the 20 districts using video cameras, 60 percent had more than five buses equipped with cameras.

Table 3. Number of buses equipped with cameras

Q. How many buses are equipped with externally mounted cameras?		
Answer Options	Response Percent	Response Count
1 bus	20%	4
1-5 buses	20%	4
more than 5 buses	60%	12
answered question		*20*
skipped question		*156*

Estimated Frequency of Stop-Arm Violations

Table 4 shows the general impression that district personnel respondents have on the frequency of stop-arm violations (not just on camera-equipped routes). Note that only 1 of 20 indicated a frequency of never or almost never.

Table 4. Estimated frequency of stop-arm violations

Q. Based on your experience, please rate the frequency of stop-arm violations?		
Answer Options	Response Percent	Response Count
Never or Almost Never	5%	1
Seldom	35%	7
Sometimes	50%	10
Often	10%	2
Always or Almost Always	0%	0
answered question		*20*
skipped question		*156*

Five of the 20 districts currently using video for stop-arm detection responded to a more detailed follow-up survey as presented below.

Number of Buses Equipped with Externally-Mounted Cameras

As shown in Table 5, camera deployment in one district includes their entire bus fleet (56 route buses) and two of the five agencies are adding stop-arm video to additional buses.

Table 5. Number of buses equipped with video

District	Response	Notes
A	56	We have 56 currently, which is all of our route buses. Eventually, over the next several years, will include all activity and spare buses (for a total of 75 buses). These cameras are not mounted externally; however, they are inside the bus
B	20	We have 3 currently but within one week will have a total of 20.
C	2	
D	2	
E	11	

Process in Reviewing the Recorded Video (Manually by School Staff, Sent to Third Party, etc.)

As shown in Table 6, all five districts have are reviewing each incident manually and then forwarding information to law enforcement.

Table 6. Processes for reviewing recorded video

District	Response	Notes
A	Manual	Driver fills out a form and the video is pulled from the bus files. The incident is isolated and pictures are printed and submitted to the appropriate law enforcement agency.
B	Manual	All video is wirelessly downloaded to a server when bus pulls into bus lot after route. If behavior or stop arm violation has occurred they radio office and let them know an incident happened and that they "marked" it (pushing a button) so the office can go to the mark and review video.
C	Manual	Manual by school staff.
D	Manual	Manual by school staff.
E	Manual	Any reviewing is done by a school administrator (Transportation Director or Building Principal).

Video Review Triggers (Bus Driver Indication, Automatically, etc.)

As shown in Table 7, the bus driver bears the responsibility of identifying the stop-arm violation and in reporting the incident to be reviewed on the video footage.

Table 7. Triggering a review of the video

District	Response	Notes
A	Driver	Bus driver must say the vehicle license plate number out-loud to be captured on the video. The bus driver must initiate the investigation not the camera.
B	Driver	Each bus driver has marking button that marks video. When stop arm violation occurs driver fills out form that describes event and vehicle and estimated speed.
C	Driver	
D	Driver	Bus driver notifies me of the violation.
E	Driver	Bus driver expresses concern to the Transportation Director.

Citation or Notice to the Driver Once a Violation is Confirmed

Each district reported the same process that begins by the school bus driver filling out a School Bus Warning Device violation report, which, along with information from the video (images) is submitted to the appropriate enforcement agency for the location in which the violation occurred.

Cost of Adding the External Camera for Monitoring Stop-Arm Violations

Table 8 shows costs experienced among the five districts for adding stop-arm video detection. The stop-arm detection is oftentimes an additional feature that supplements internal bus video/audio recording and storage. A three or four camera DVR system allows the user flexibility in where the cameras are used (internal versus external).

Table 8. Costs to install video on a bus

District	Response
A	Typically use a 3 camera system (2 internal, 1stop arm) and this runs $2,100 per bus. Cost to add a single camera would be approximately $300.
B	We equipped 20 route buses with four cameras each. Three internal and one external. Cost for project approx. $46,000 paid for with SAVE funds.
C	Approximately $275 to $300 for a single camera and cable, would still need a DVR.
D	Approximately $150 for a single camera and cable, would still need a DVR.
E	Approximately $1,500

Effectiveness of Systems

Table 9 provides the various district responses on whether these systems are effective. Three of five agencies indicated they felt they are effective. One agency provided an appropriate contrast between the effectiveness of the technology versus the process used in Iowa to issue violations.

Table 9. Opinions regarding effectiveness of stop-arm cameras

District	Response
A	The technology is effective, however, the process is limited in that it takes considerable effort and cost on the part of the bus driver, school transportation staff, and finally law enforcement to ultimately issue violations.
B	Too early to tell as we are just getting up and running with them.
C	Yes
D	Yes
E	Yes, it has helped us verify several violations.

Major Technical or Policy-Related Problems Faced in Using the External Camera System

One agency noted that the electronics (cameras, cables, DVRs, and hard drives) are a higher-fidelity component for the bus industry and that the installation and maintenance of this equipment requires staff support outside the typical bus mechanic skills. Another agency stated that they had to upgrade the resolution of their external cameras to be able to capture identifying vehicle characteristics.

FEASIBILITY FOR BUS LOADING/UNLOADING ON HOM- SIDE ONLY

Kadyn's Law requires a study be conducted that considers the feasibility of requiring school children to be picked up and dropped off on the side of the road on which their home is located, referred to within this report as home-side. This issue was addressed through meetings and documenting existing practices within several districts and in developing an urban and rural home-side loading scenario using actual routes within a district.

Background

To load and unload students on both sides of a road, school bus drivers have historically "crossed" students to the bus in the morning or crossed them to their stop in the afternoon. In most states, the driver remains in the driver's seat and surveys traffic, giving the signal to cross when all traffic has stopped. The extreme case is in California where drivers leave the bus and walk a child across the road. Some districts have gone even further and established that no children will be required to cross the road to get to the bus stop.

A more common procedure is for a district to identify certain roads within a district as "no crossing" roads because of the speed and density of traffic. On these roads, students would not be required to cross the road from the bus stop to the bus or vice versa. If a change to a no-crossing policy means a longer bus ride for some students, it is acceptable, as long as the length of ride remains within state and district guidelines (NYSED 2012).

State of Practice

The research team worked with Iowa DOE staff to identify two school districts in consideration of the feasibility of requiring home-side loading. Information was obtained from each district via several conference calls as a group and through a half-day on-site work session.

In general, districts must balance achieving a sufficient student load per bus route with the maximum ride time limit allowed by the state, which is 60 minutes. The practice of each district is summarized below:

Indianola

The Indianola school district covers 159 square miles and transports 1,720 students per day out of an enrollment of 3,600 students. The district has 23 route buses and an additional eight substitute or activity buses. The activity buses run roughly 800 to 1,000 extra trips per year.

Indianola does not use stop-arm cameras at this time. They do have internal video with three video cameras on each regular route bus and their back-up buses have two cameras each. The Indianola school district pays roughly $1,300 for a three-camera system, which records audio

and video and can accommodate up to six cameras. The cost per camera is roughly $200 and the district uses a variety of lenses (2, 6, and 8 millimeters).

Within the urban areas, bus stops are typically located at mid-block points where most kids are located. A certain number of students on every street will cross a street to get to/from these mid-block stops. The district has three to four discretionary routes for students who live within the two- mile radius but would have to cross a major highway to get to school (personal phone conversation September 18, 2012 with Danny Thede).

Atlantic

The Atlantic school district covers 206 square miles and transports 328 students per day out of an enrollment of 1,409 students. The district has 10 route buses (seven rural and three special) and six to seven activity buses. The activity buses run roughly 700 extra trips per year and do not have in-town pick up locations.

From a best practice perspective, roughly 90 percent of the district's stops are home-side. The remaining 10 percent require the student to cross the road; however, there is an aid on the bus for assistance (personal phone conversation September 18, 2012 with Dave Eckles).

Analysis

General Impression

The electronic survey submitted to Iowa school districts as a part of this research included a statement on home-side loading in which respondents were asked to comment. The survey responses, as provided in Table 10, show that most respondents felt that home-side loading is a feasible alternative toward improving school bus safety (given 52 percent either agree or strongly agree as opposed to 28 percent who disagree or strongly disagree).

Table 10. Survey on the impacts of a home-side loading requirement

Q. Please comment on the following statement: "Requiring home-side loading is a feasible alternative towards improving school bus safety".		
Answer Options	Response Percent	Response Count
Strongly disagree	8%	10
Disagree	20%	25
No idea	20%	25
Agree	39%	49
Strongly Agree	13%	16
answered question		*125*
skipped question		*51*

Before quantifying the impacts of mandatory home-side loading, two districts were asked to share their impressions of such a requirement from an operations perspective. In general, their impressions were that, in most cases, they prefer home-side loading; however, this is not feasible for every route (particularly within urban areas).

The respondents shared that the home-side loading requirement would have an impact on the district's ability to customize routing plans and offer discretionary routes, and require additional routes given the 60 minute ride-time limit. The additional routes would be less efficient given fewer students per bus.

In rural areas, a home-side requirement would, in some cases, require the bus drivers to travel considerable distances to turn around, and compliance could be a challenge and actually a detriment, if one child is dropped off 15 minutes earlier than a child living across the street.

Quantifying Impacts Using Routing Case Studies

A working session was held at the Indianola school district bus facility with transportation, DOE, and research staff to quantify the impacts of a home-side loading requirement for an urban and rural route. The results are summarized below.

The Indianola district uses a software routing package (TransFinder) to establish their routing. This software supports their planning and operations efforts and provides feedback in terms of route mileage, bus-load efficiency, ride time for the driver and students, and numerous other

route details. Each bus route is detailed from the beginning of the pre-trip to leaving the garage and for each stop by address and number of students at the stop. Drivers are also given information on student count per stop, whether the bus has to turn-around or not, mileage, and when the bus will return to the garage for the post-trip inspection.

The district does have internal video with three video cameras on each regular route bus and two per back-up bus. The district pays roughly $1,300 for a three-camera system, which records audio and video and can accommodate up to six cameras. The cost per camera is roughly $200 and they use a variety of lenses (2, 6, and 8 millimeters).

The routing software was used to contrast existing operations for a single urban and rural route versus the same routes under a home-side loading mandate. These results follow.

Urban Route

A typical urban route was selected within the community. School bus stops within this setting are typically at mid-block to allow for the bus to turn on their flashing lights at least 150 feet in advance of the stop. Students who live within a three to five block area are expected to pool at the designated mid-block location. Figure 8 shows an illustration of the route as it exists today.

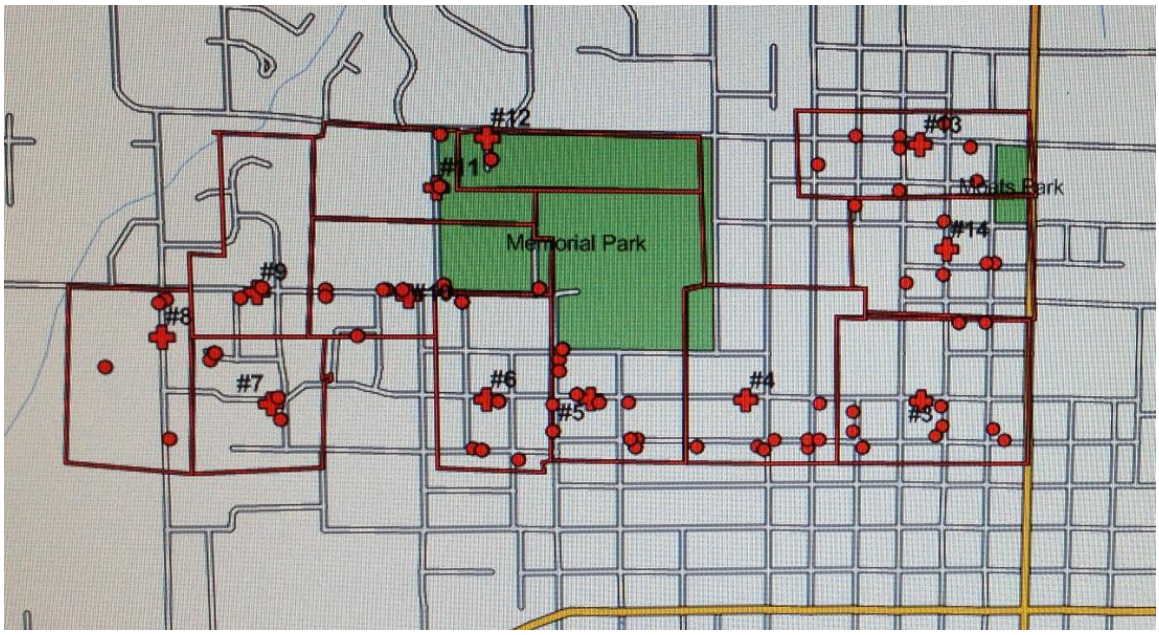


Figure 8. Urban route under existing conditions

Red circles indicate student locations, red squares are the boundaries for students per pooled stop location, and red crosses indicate stop locations. Figure 9 shows the same bus route under home-side loading.

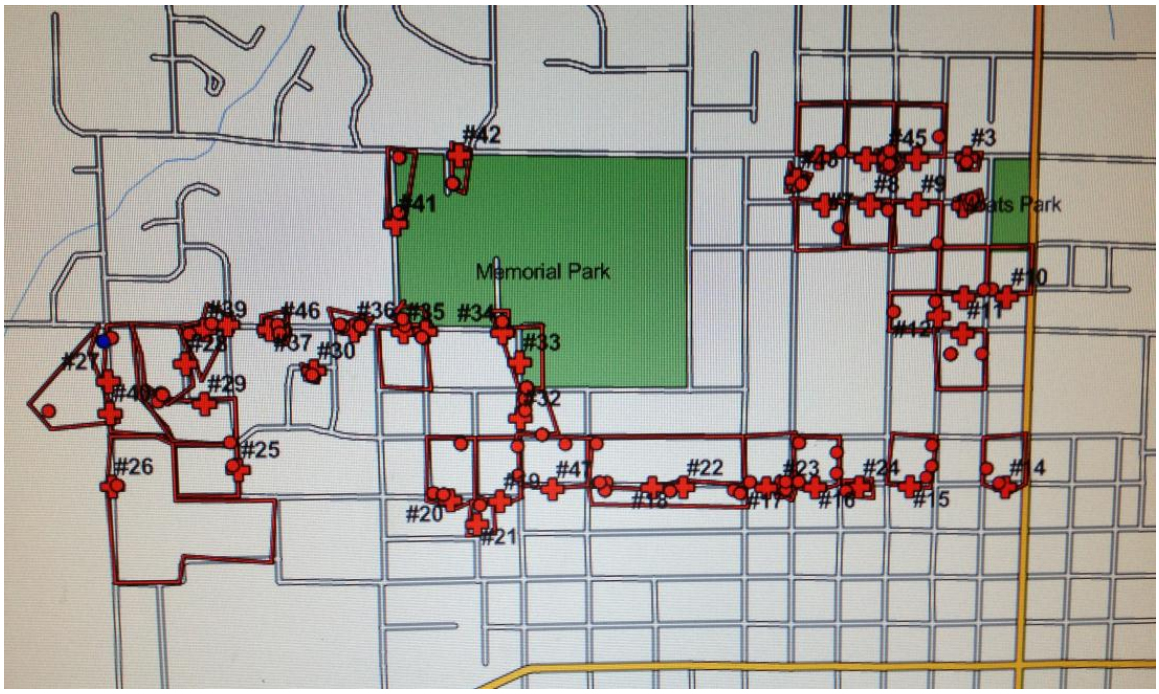
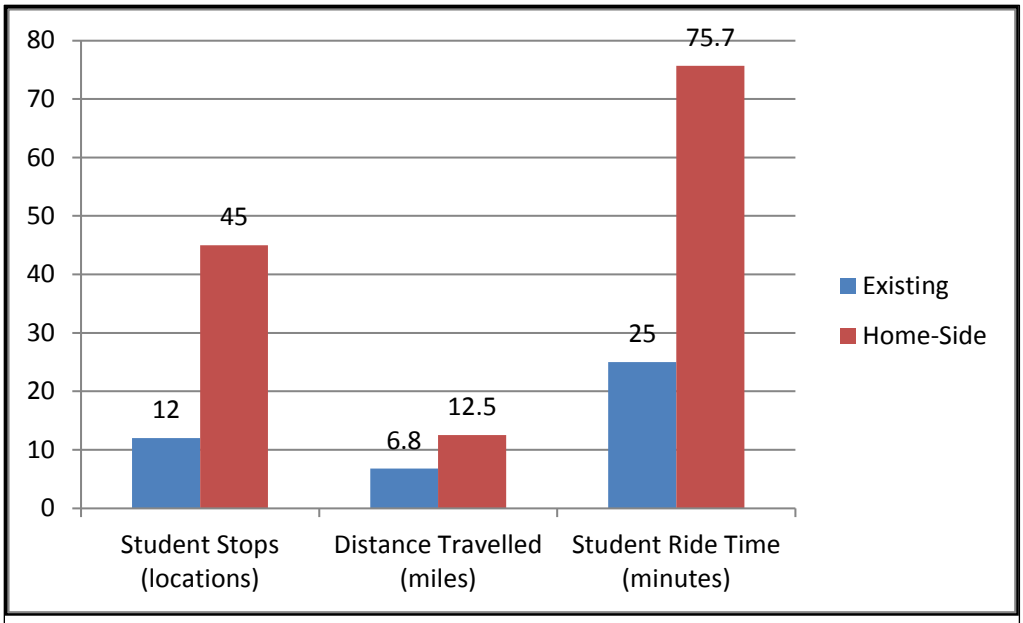


Figure 9. Urban route under home-side loading

Under this scenario, one stop location is established for each block by direction of travel, so the bus essentially travels each roadway twice. Using the district routing software tool, the two scenarios (existing versus home-side loading) were contrasted as shown in Figure 10.



Urban Metric	Loading Scenario		Difference	Existing Times (X)
	Existing	Home-Side		
Total Students	88	88	0	
Student Stops (locations)	12	45	33	3.8
Distance Travelled (miles)	6.8	12.5	5.7	1.8
Student Ride Time (minutes)	25	75.7	50.7	3.0

Figure 10. Contrast for home-side loading on urban route

As shown, there are considerable differences between the two scenarios in terms of increased stops (3.8 times as many stops, 1.8 times the number of miles traveled, and 3 times the number of minutes students are on the bus). In addition, the student ride time under the home-side loading condition exceeds the 60 minute limit, which would need to be addressed through either adding an additional route or adjusting adjacent route coverage.

Rural Route

A typical rural route was also selected within the community. School bus stops within this setting are typically at the student's driveway or at a pooled location of several drives or side streets. Figure 11 shows the rural route evaluated.

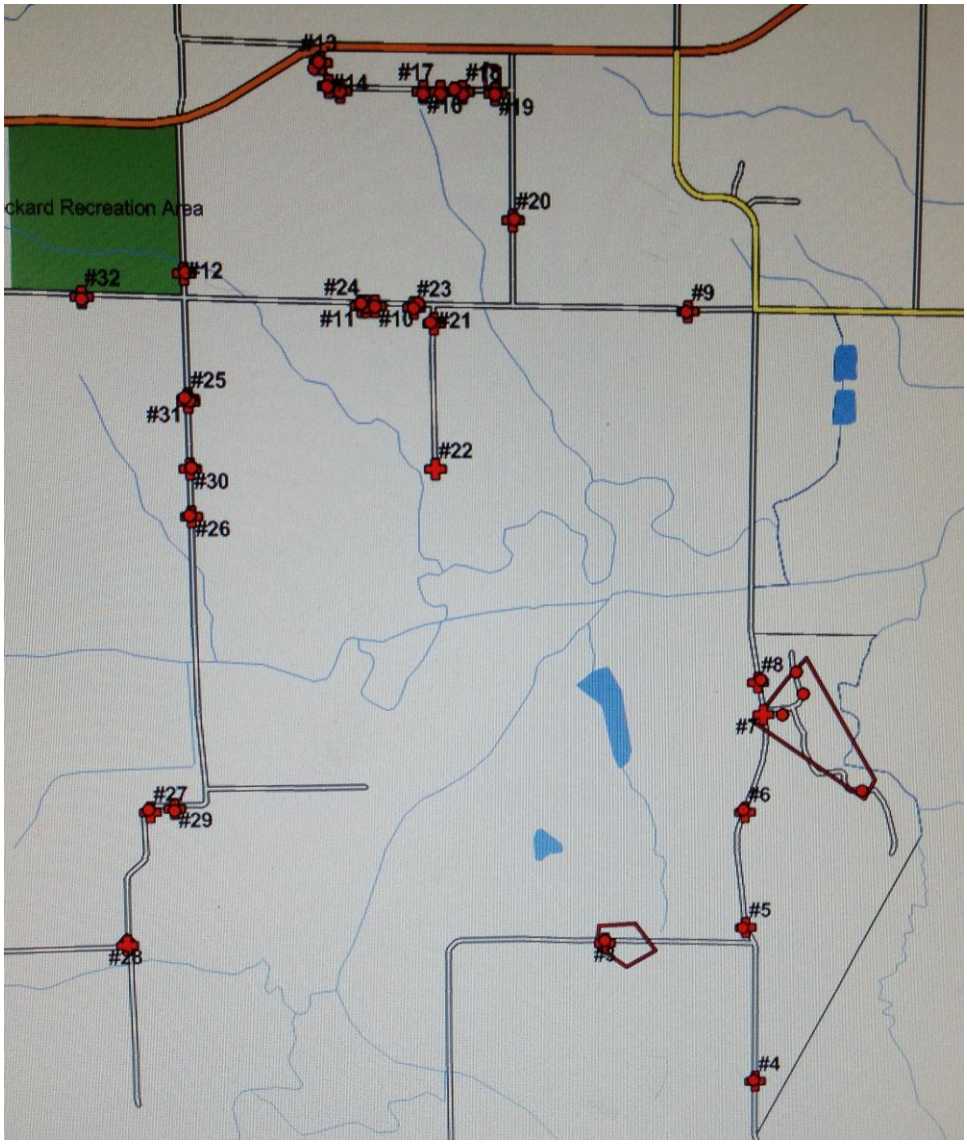
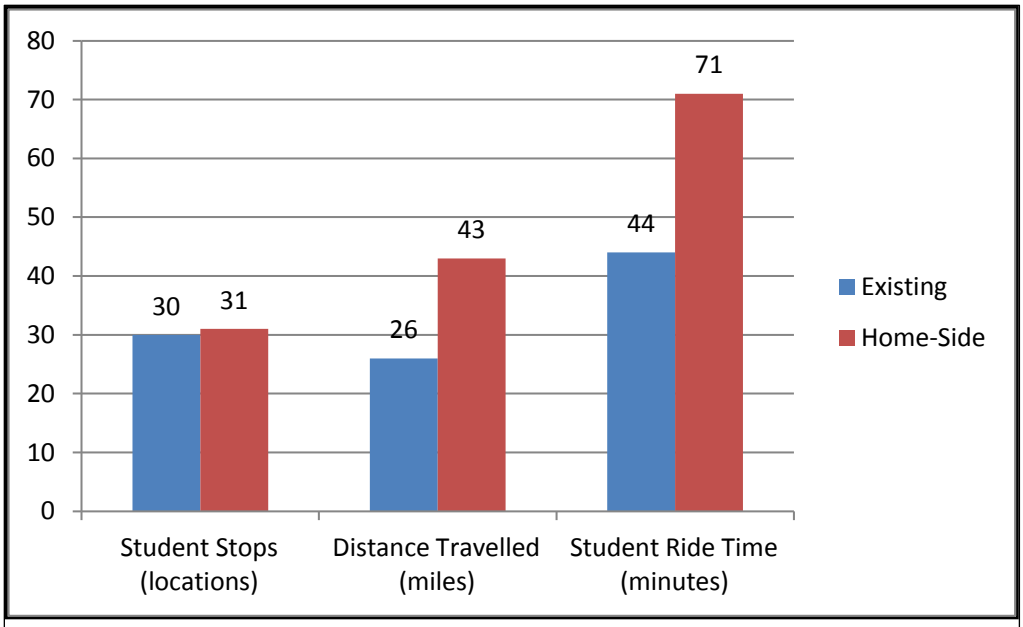


Figure 11. Rural route evaluated

The difference between existing and home-side loading is minimal in terms of graphic depiction (not shown); however, there is a dramatic difference in the bus path given that picking up students on the home-side requires travel in both directions and several situations where the bus must turn around.

The district routing software tool was again used to evaluate the two scenarios (existing versus home-side loading) with the results shown in Figure 12.



Rural Metric	Loading Scenario		Difference	Existing Times (X)
	Existing	Home-Side		
Total Students	71	71	0	
Student Stops (locations)	30	31	1	
Distance Travelled (miles)	26	43	17	1.7
Student Ride Time (minutes)	44	71	27	1.6

Figure 12. Contrast for home-side loading on rural route

As shown, there are differences between the two scenarios; however, these changes are quite different than with the urban setting. As shown, the number of stops increased by only 1 as opposed to an increase of 33 in the urban setting. The biggest rural difference is found in the distance traveled (1.7 times as much as exists today) and in the student ride time (1.6 times the existing ride time minutes).

As with the urban scenario, the student ride time under the home-side loading exceeds the 60 minute limit, which would need to be addressed either through adding an additional route or by adjusting adjacent route coverage.

Costs

The fiscal impact of home-side loading was estimated based simplistically on change in vehicle mileage and average cost per mile, which were provided (Iowa DOE 2012).

In addition, 180 days were used as the estimated number of days of operation per year. Other factors including the potential cost of an additional bus route, added bus operational costs for extra stops, driver time, and related issues were not included, given this would have required a

much more significant review of district costs and a revision of all district routes to identify net changes.

The derived cost impacts for home-side loading were calculated for one urban and one rural route and from a mileage perspective only. As shown in Table 11, these impacts are estimated at $8,229 per urban route annually and $24,541 per rural route annually.

Table 11. Fiscal impact of home-side loading for one urban and rural route

Route Setting and Loading Condition	Mileage	Costs per Mile ($)	Change in Costs			
			AM Route	PM Route	Daily	Annual
Urban (1 bus route only)						
Existing	6.8	4.01	$ 27	$ 27	$ 55	$ 9,816
Home-Side	12.5	4.01	$ 50	$ 50	$ 100	$ 18,045
Difference =	5.7		$ 23	$ 23	$ 46	**$ 8,229**
Rural (1 bus route only)						
Existing	26	4.01	$ 104	$ 104	$ 209	$ 37,534
Home-Side	43	4.01	$ 172	$ 172	$ 345	$ 62,075
Difference =	17		$ 68	$ 68	$ 136	**$ 24,541**

Given this district has 4 urban routes and 19 rural routes, the cost impact by simple extrapolation results in an annual increase of $499,195 for the district.

The Indianola district has an existing net operating cost of $825,581 per year, which equates to an average cost per pupil transported of $478. As shown in Table 12, the home-side loading would increase annual net operating costs by a factor of 1.6 to $1,324,777 and increase the average cost per pupil transported to $767.

Table 12. District cost impacts for home-side loading

Loading Scenario	Net Operating Costs	Average Cost Per Pupil Transported
Existing	$825,582	$478
Home-Side	$1,324,777	$767

DRIVER TRAINING CURRICULUM

The driver education curriculum used by schools and private firms is based on the Iowa Driver's Manual. The current manual has a section specifically devoted to School Bus regulations as shown Figure 13.

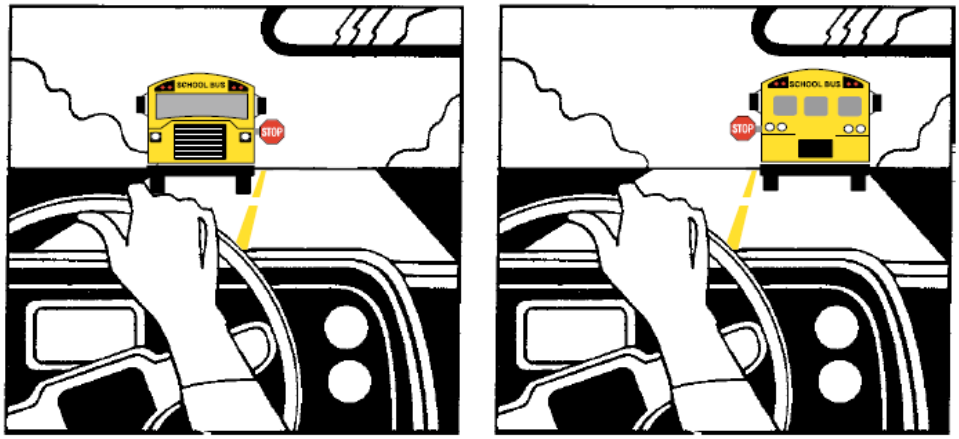
School Buses

When you meet an oncoming school bus displaying flashing amber lights, you must slow down to no more than 20 mph and be prepared to stop. If the red lights are flashing or if the stop arm is out, you must come to a complete stop at least 15 feet from the bus. You must remain stopped as long as the red lights flash or the stop arm is out.

The only exception to this is where you are approaching the bus from the opposite direction on a road with at least two lanes in each direction.

When overtaking a school bus, you may not pass when red or amber warning lights are flashing.

After a school bus has stopped to let students off, watch for children on the side of the road.



If the red lights are flashing or if the stop arm is out, you must come to a complete stop at least 15 feet from the bus and remain stopped as long as the red lights flash or the stop arm is out.

Figure 13. Section on school buses from the Iowa Driver's Manual

The researchers contacted several driver education instructors who confirmed that they include this material specifically in their courses. One instructor, from Monticello, reported as follows:

“Information is given in PowerPoint presentations that include articles and news stories that involve accidents between buses and young drivers. There is also a section in the book dealing with buses that is covered. I also got information from our transportation director regarding changes in the law ($$$ - increases in fines). We cover through lecture/PowerPoints what to do if you are meeting or passing a bus in a two-lane road and a divided highway. The state trooper and speaker from the DOT also discussed it briefly in their presentation.”

All US states and Canadian provinces have school bus traffic stop laws requiring traffic approaching from either direction to come to a complete stop for buses loading and unloading passengers. However, the specifics of each state vary slightly, particularly for multi-lane roadways. Most jurisdictions allow oncoming traffic to pass a stopped school bus on a divided highway, except for the following jurisdictions:

- West Virginia
- Arkansas (must have median at least 20 feet wide)
- New York
- North Dakota
- American Samoa
- Guam
- British Columbia
- Nova Scotia
- Prince Edward Island
- Northwest Territories
- Nunavut

Some states have specific exceptions for other types of multi-lane roads and all of these exceptions are in addition to the divided highway exception:

- Washington – On roads with three or more lanes, oncoming traffic is not required to stop and this includes two-lane streets with a center turning lane (Law has increased safety levels for children because they are not required to cross any roads with more than two lanes to reach a school bus stop)
- California/Delaware/Illinois/Iowa/Mississippi/Missouri/South Dakota/Ohio/Idaho – On highways with four or more lanes, oncoming traffic is not required to stop
- North Carolina/Utah – Oncoming traffic not required to stop on highways with four or more lanes with center turning lane or divide

Table 13 provides a summary of the driver manual content regarding school buses for the 50 states.

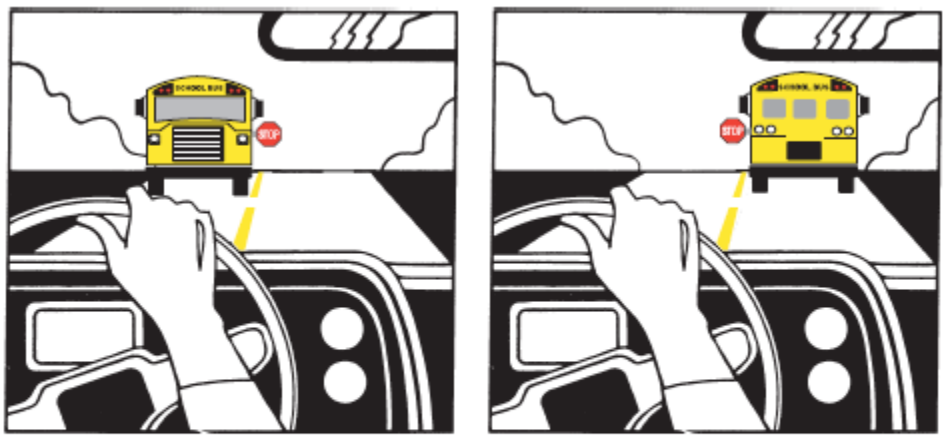
Table 13. Summary of driver manual content for school bus stopping

State	# of Pages addressing School Bus	# of Diagrams Included	Contents of Diagrams
Alabama	0.75	3	1 flashing bus lights diagram, 2 overhead stopping proceduce demonstrations
Alaska	1	2	1 picture of children crossing, 1 stopping procedure demonstration
Arizona	0.5	0	
Arkansas	0.5	2	1 picture of bus from behind, 1 from in front, both with stop signs extended
California	0.5	1	Picture of bus flashing red lights, pedestrians crossing street in front of bus
Colorado	0.2	1	Picture of bus with red flashing lights and stop sign, children crossing street
Connecticut	0.1	0	
Delaware	1	4	Four lane vs 2 lane laws, view of school bus with lights from front & behind
Florida	0.5	3	2 vs 4 (paved median) vs 4 (unpaved median) lane diagrams
Georgia	2.5	5	2 vs 2 (+center turn lane) vs 4 (no median) vs 4 (+center turn lane) vs 4 (+median) lane diagrams
Hawaii	0.75	1	Flashing light diagram with stopped cars behind bus, not able to tell whether oncoming cars are supposed to stop or not
Idaho	0.75	3	2 vs 2 (+center turn lane) vs 4 lane diagrams
Illinois	0.5	1	Picture of bus with stop sign out, car behind and in front of it
Indiana	0.75	2	Drawing of bus with STOP arm out and flashing lights, from front and behind
Iowa	0.25	2	Drawing of bus with STOP arm out and flashing lights, from front and behind (driver perspective)
Kansas	0.5	1	Drawing of bus with STOP arm out, with people crossing street
Kentucky	0.5	2	2 vs 4 (no median) lane diagrams
Louisiana	0.75	3	2 vs 4 (no median) vs 4 (divided) diagrams
Maine	0.5	3	2 vs 4 (no median) vs 4 (divided) diagrams
Maryland	0.25	1	Picture of stopped bus from behind, children crossing street
Massachusetts	0.25	1	Drawing of stopped school bus from perspective of driver approaching from behind
Michigan	1	3	(From behind) Drawing of bus w/yellow overhead lights, drawing of bus w/red lights and STOP arm, drawing of bus with yellow hazard lights
Minnesota	1.25	2	Drawing of bus with red lights and STOP arm, from front and behind
Mississippi	1	1	2 lane diagram
Missouri	0.75	1	2 lane diagram
Montana	1.5	3	2 vs 4 (no median) vs 4 (divided) diagrams
Nebraska	1	3	2 drawings of school buses, 1 diagram of a 2-lane stopping situation
Nevada	0.5	1	2 lane diagram
New Hampshire	0.5	0	
New Jersey	1	1	2 lane diagram
New Mexico	0.2	0	
New York	0.5	0	
North Carolina	0.5	5	2 vs 2 (+center turning lane) vs 4 (no median) vs 4 (divided) vs 4 (+center turning lane)
North Dakota	0.2	0	
Ohio	1	0	
Oklahoma	0.5	1	2 lane diagram
Oregon	1	3	4 lane (+center turning) vs 4 lane (no center turning/divider) vs 4 lane (divided)
Pennsylvania	0.25	1	4 lane (no center turning/divider) diagram
Rhode Island	0.25	2	Drawing of bus with STOP arm extended, from front and behind
South Carolina	2	3	Cartoon, 2 lane vs 4 lane divided diagrams
South Dakota	1	2	Drawing of bus with STOP arm extended, from front and behind
Tennessee	1.5	6	Drawing of bus with STOP arm extended, from front/back/2 lane diagram/ Red&Yellow flashing light inserts/ Bus at Int, from above/ School bus 'Danger Zones'
Texas	0.5	1	2 lane diagram
Utah	0.75	1	1 bus drawing
Vermont	0.5	0	
Virginia	0.5	2	Diagram of bus at intersection, of bus on 4 lane divided highway
Washington	0.75	1	Drawing of school bus with STOP sign, from front
West Virginia	0.5	0	
Wisconsin	0.5	3	2 vs 4 (no median) vs 4 (divided) diagrams
Wyoming	0.75	3	4 (no divider) vs 4 (divided) diagrams

Observations and Considerations for the Iowa Driver's Manual

Based on review of other state's driver manual content, the researchers noted several illustrations that, in our opinions, could be used to improve driver comprehension of the school bus stop requirements. However, no research has been done to verify the public's understanding or opinion of the illustrations. These are included as best practices based on the expert opinion of the researchers and could be used in driver education course materials, public outreach materials, and updates to the driver manual.

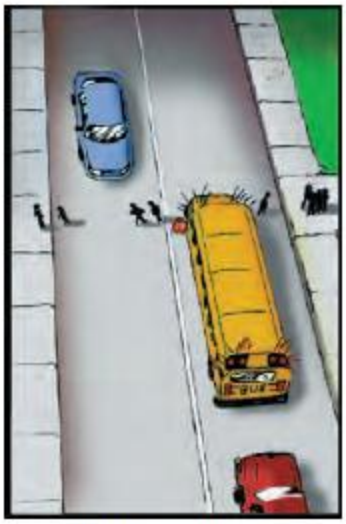
The current Iowa illustration presents a driver's eye view of the forward and rear approaches to a school bus (Figure 14). This view may be more understandable than a birds-eye view for drivers not comfortable with reading maps and plans. A few other states utilize this approach, and we feel Iowa's current illustration is one of the better ones using this view.



If the red lights are flashing or if the stop arm is out, you must come to a complete stop at least 15 feet from the bus and remain stopped as long as the red lights flash or the stop arm is out.

Figure 14. Images from the Iowa Driver's Manual

The image in the Colorado manual is shown in Figure 15 and includes children crossing the street in front of a car in the opposing lane. The action depicted in this image may help provide motivation for drivers to stop because they can see the children crossing from the bus to the opposite side of the road. Figure 16 is an example from the Kansas driver manual that includes pedestrians in the image as well.



SCHOOL BUS: You must stop your vehicle at least 20 feet before reaching a school bus that is stopped with its red lights flashing whether it is on your side of the road, the opposite side of the road, or at an intersection you are approaching.

You must remain stopped until the flashing red lights are no longer operating. Watch carefully for children near the school bus and children crossing the roadway before proceeding.

You are not required to stop if the bus is traveling toward you on a roadway that is separated by a median or other physical barrier.

Figure 15. Image from the Colorado driver manual

STOPPING

A complete stop is required for the following:

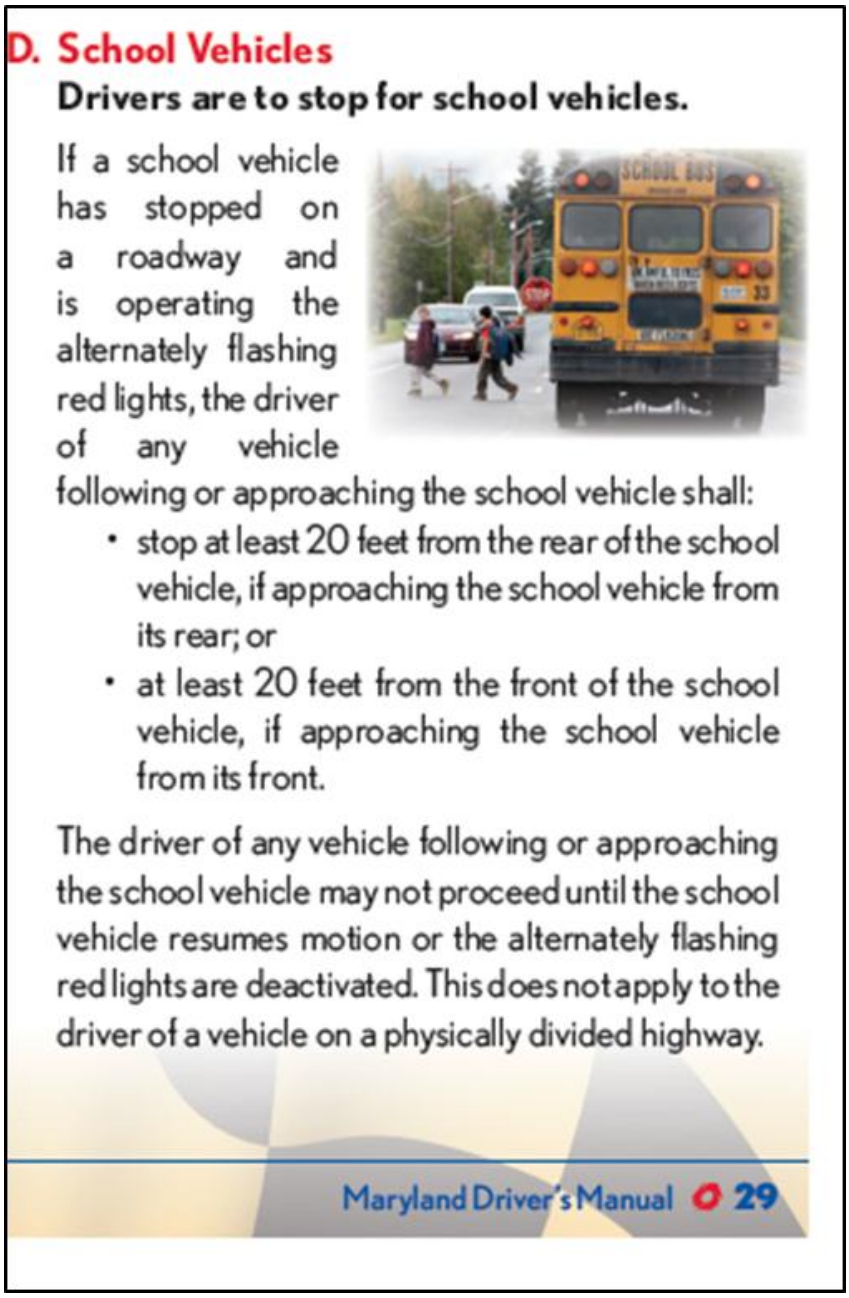
1. When you see a stop sign, you must stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection or, if none, then at a point nearest the intersecting roadway.
2. When coming from an alley, private driveway or building within a business or residential district.
3. When a school crossing guard is displaying an official flag in a STOP position.
4. You must stop when meeting or overtaking a school bus, church bus or day care bus stopped to pick up or let off children. You must remain stopped until the STOP signal is retracted and the red lights are turned off. Approaching traffic in the opposite roadway of a divided highway shall not be required to stop, even if the school bus has the stop-arm extended and the alternately flashing warning signal lamps on.
5. When directed by a flagperson or any traffic control device at railroad crossings.
6. When directed by a flagperson at a construction site, or at anytime when directed by a police officer.
7. When an emergency vehicle is coming toward you or approaches from behind and is displaying flashing red lights and/or sounding a siren.

BOTH CARS MUST STOP

— 20 —

Figure 16. Image from the Kansas driver manual

Maryland also illustrates children walking but uses a photograph as shown in Figure 17. This may result in higher printing costs, but provides an actual image of the pedestrian activity and, therefore, may help reinforce the motivation for stopping more than a drawing or artist's sketch does.



D. School Vehicles

Drivers are to stop for school vehicles.

If a school vehicle has stopped on a roadway and is operating the alternately flashing red lights, the driver of any vehicle following or approaching the school vehicle shall:

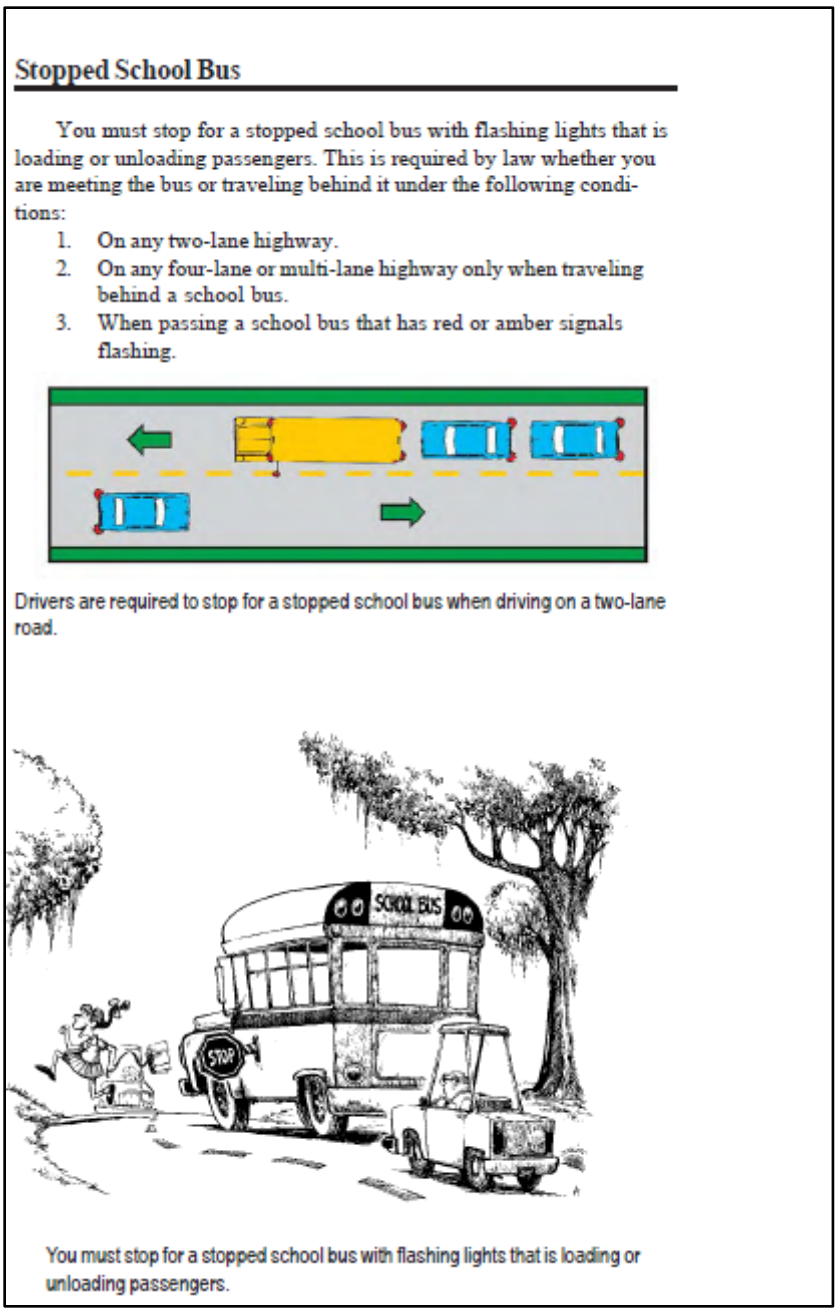
- stop at least 20 feet from the rear of the school vehicle, if approaching the school vehicle from its rear; or
- at least 20 feet from the front of the school vehicle, if approaching the school vehicle from its front.

The driver of any vehicle following or approaching the school vehicle may not proceed until the school vehicle resumes motion or the alternately flashing red lights are deactivated. This does not apply to the driver of a vehicle on a physically divided highway.

Maryland Driver's Manual 29

Figure 17. Image from the Maryland driver manual

Figure 18 shows how South Carolina has taken a light-hearted approach to illustrating the pedestrian activity. Again, this is eye-catching and may be particularly good for outreach materials.



Stopped School Bus

You must stop for a stopped school bus with flashing lights that is loading or unloading passengers. This is required by law whether you are meeting the bus or traveling behind it under the following conditions:

1. On any two-lane highway.
2. On any four-lane or multi-lane highway only when traveling behind a school bus.
3. When passing a school bus that has red or amber signals flashing.

Drivers are required to stop for a stopped school bus when driving on a two-lane road.

You must stop for a stopped school bus with flashing lights that is loading or unloading passengers.

Figure 18. Image from the South Carolina driver manual

Figure 19 shows where the Delaware manual combines illustration approaches and shows children crossing from the driver's eye view and also includes a plan view/aerial of the roadway configuration. Because of great differences in how people interpret graphics, this approach of using both the aerial view and the driver's viewpoint should be considered.

Stopping For School Buses

You must always stop before reaching any school bus from either direction when it is stopped to load or unload school children except when you are on the opposite side of a highway having four or more lanes, even then proceed slowly.

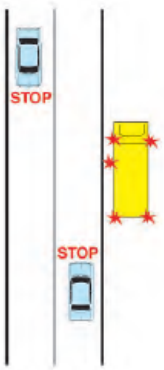
Yellow Lights

School buses have two overhead alternately flashing yellow lights both front and rear. They will be activated approximately 10 seconds prior to the overhead flashing red lights to warn drivers of approaching vehicles that a stop to load or unload school children is about to be made. Approach a bus flashing these yellow lights with caution and anticipate a stop. Children may be waiting for the bus or may be running to board it.

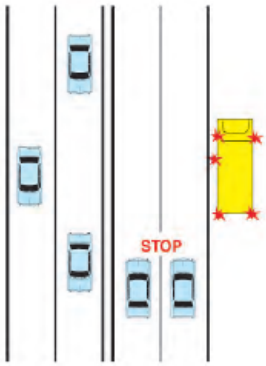
Red Lights

The overhead alternately flashing red lights and stop arm will be activated when the bus is stopped to pick up and discharge pupils. You must not proceed until the red lights have stopped flashing, and the stop arm has been retracted, then proceed cautiously.

Less Than 4 Roadway Lanes
BOTH Directions Must STOP



4 or More Roadway Lanes
Only Traffic Following Must STOP



SECTION FOUR 87

If any vehicle is witnessed by a police officer, school bus operator, or school crossing guard to be in violation of the school bus stop law and the operator is not otherwise apparent, it shall be assumed that the person in whose name the vehicle is registered committed such violation.

Penalties and Suspension of License for Passing a Stopped School Bus with Red Lights Flashing

Whoever is convicted of passing a stopped school bus with overhead and stop arm red lights flashing shall, for the first offense, be fined not less than $115.00 nor more than $230.00, or imprisoned not less than 30 days nor more than 60 days, or both. For each subsequent like offense occurring within three years, such person shall be fined not less than $115.00 nor more than $575.00, and imprisoned not less than 60 days nor more than six months.

Upon conviction for passing a stopped school bus with overhead and stop arm red lights flashing, the Division of Motor Vehicles shall suspend the driver license and/or driving privilege for a period of one month for a first offense, six months for a second offense, or one year for a third or further subsequent violation occurring within three years of a prior violation. A conditional license may be issued following a suspension for a second offense after serving a minimum period of suspension without driving authority of three months. A conditional license may be issued following a suspension for a third or further subsequent offense after serving a minimum period of suspension without driving authority of six months. No driving authority is permitted during the one month suspension for a first offense.

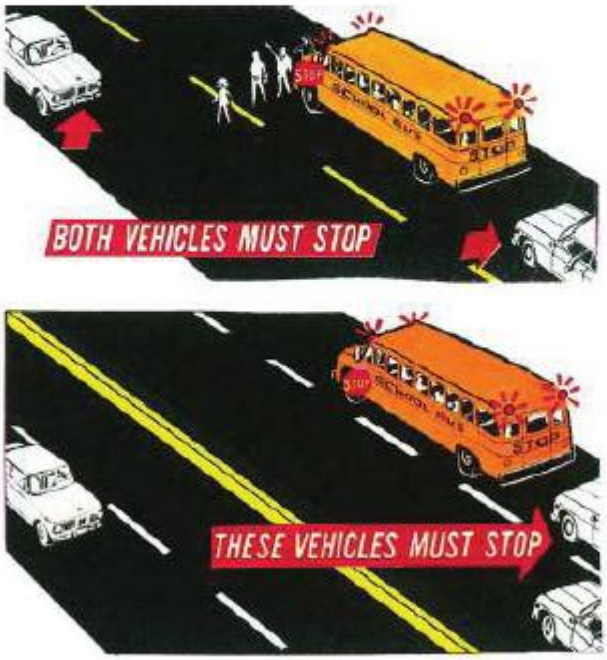
Figure 19. Illustrations from the Delaware driver manual

To illustrate which vehicles must stop for two-lane and four-lane undivided roads, Kentucky has a good perspective view image showing pedestrian activity and indicating required stops as shown in Figure 20.

If another driver makes a mistake, do what you can to help him out. You may need to speed up, slow down, change lanes, or even stop. Do whatever the situation demands as long as a collision is avoided.

- School Buses. Where there are school buses, there are usually children. Children are likely to do something unexpected, so be prepared.
- When you come to a school or church bus that is stopped on any roadway to load or unload passengers, you must STOP. By law you must remain stopped until all people are clear of the roadway and the bus is in motion. A stop is NOT required when approaching a stopped bus from the opposite direction upon a highway of four or more lanes.

However, a STOP is required when following a bus that is stopped on a two-lane road or you are going in the opposite direction of the bus on a highway that has less than four lanes, as they are generally not divided.



22

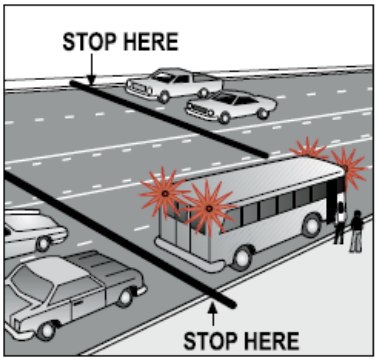
Figure 20. Image from the Kentucky driver manual

Figure 21 shows another example where Oregon illustrates the difference for two-lane, four-lane undivided, and four-lane divided roadways. The use of the extended stop bar line in the illustration reinforces the location of the stop.

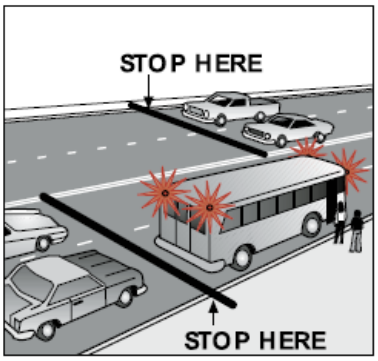
School, Transit, Church, and Worker Buses

Stopping for School Buses

Oregon school buses have flashing amber and flashing red lights near the top of the bus on the front and rear. School buses are also equipped with a stop arm that extends out from the left side of the bus near the driver's window. The stop arm will extend when the red lights begin to flash.



School bus drivers turn on flashing amber lights to warn other traffic that the bus is about to stop on the road to load or unload children. You should get ready to stop. When the red lights begin to flash, this means drivers meeting or overtaking the bus from either direction must stop before reaching the bus. You must remain stopped until the bus driver turns off the flashing red lights.



The school bus stop law applies on any roadway with two or more lanes of traffic. There is one

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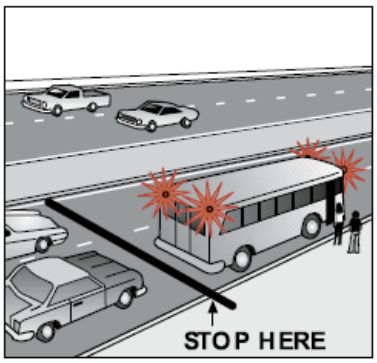
exception to the law. If you are on a divided highway with two roads separated by an unpaved median strip or barrier, you must stop only if you are on the same side of the road as the bus. A painted median strip or a center lane used only for left turns does **not** create two separate roads. Where this situation exists, **all** lanes of traffic must stop.



School bus drivers may report vehicles that improperly pass school buses. The report may be forwarded to the local law enforcement agency for investigation.

All school buses and some school activity vehicles must stop at railroad crossings. The driver must open the bus door and be sure the tracks are clear before proceeding.

Figure 21. Image from the Oregon driver manual

CONCLUSIONS

As a result of the March 2012 passage of Kadyn's Law in Iowa, this project addressed several specific safety study elements:

- Use of cameras mounted on school buses to enhance the safety of children riding the buses and aid in enforcement of motor vehicle laws pertaining to stop-arm violations
- Feasibility of requiring school children to be picked up and dropped off on the side of the road on which their home is located
- Inclusion of school bus safety as a priority in driver training curriculum

Concluding remarks per study element are noted below.

Use of Cameras to Reduce Stop-Arm Violations

Stop-arm cameras by themselves are of little value without a supporting process that results in violations for those who break the law. The technology needed to record and process violations varies. However, the technology is becoming much easier to acquire, given that many school districts have already equipped their buses with internal cameras and, therefore, adding an additional camera for stop-arm violations is a logical next step.

Twenty Iowa school districts confirmed they are using stop-arm cameras as a deterrent. Districts ranged from one or two cameras up to 56 cameras (one for every route bus used) within a specific district.

Although some district personnel felt it was too early to tell, most commented that the stop-arm cameras are considered to be effective and assist in verifying violations. Although the literature search did not provide a detailed field evaluation on the effectiveness of using cameras as a deterrent, other studies did document the effectiveness of other bus strategies (to increase awareness).

Stop-arm cameras do aid in enforcement of motor vehicle laws and enhance safety if there is an effective and sustainable process to turn camera images into violations. Whether or not Iowa school districts currently have an effective and sustainable process to rely on is up for debate. Currently, they do. However, as more cameras are added each day, they probably do not.

Processing violators is a laborious task for all parties involved. It is currently up to the school bus driver to note each stop-arm violation. The school district must then isolate the images and provide this to the local law enforcement agency. Law enforcement then has to verify and deliver the violation to the motorist.

As noted in this report, North Carolina went through a decade of increased penalties and fines for stop-arm violations, yet little progress was made until they enacted a law that allowed for automation and third-party involvement.

If the stop-arm violation rates are even close to that reported by the National Association of State Directors of Pupil Transportation Services (NASDPTS)—with 100,000 bus drivers reporting that 88,025 vehicles passed their buses illegally on a single day—the addition of stop-arm cameras on a fraction of the school buses in Iowa could swamp the school district and law enforcement agency abilities to prosecute these dangerous violations.

As with any new law, some enhanced judicial outreach will help to align convictions with the revised penalties. Given that the law was enacted in March, a review of the "failure to stop for a school bus" convictions between August 15 and October 31 showed that even though Kadyn's Law requires a minimum fine of $250 for the first offense, 105 of the 162 convictions (65 percent) had a fine amount of less than $250.

Thinking forward, the research team suggests that consideration be given to modifying the current Iowa model and penalties to be more aligned with the administrative model commonly used for red light running:

Red light running cameras typically work in the following way. The city either purchases the cameras or leases the cameras from a vendor. In most cases, the city uses the vendor to preview violations. The vendor identifies and removes red light running events that are not enforceable, such as an emergency vehicle passing through the intersection. The vendor also removes events where the system was not functioning or it cannot be determined if red light running occurred. The vendor then forwards potential red light running violations to the city enforcement office, where officers review the events and then issue citations.

The majority of camera systems in the US take only a snapshot or video showing the forward and/or rear license plate. As a result, the ticket is a civil penalty similar to a parking ticket, which is issued to the owner of the vehicle. As a result, the driver does not receive a moving violation, and the fines for red light running, which vary by jurisdiction, range from $65 to $195 in Iowa. To target the driver, the camera system would need to take a snapshot of the driver's face and this has proved too controversial for cities to address.

Enhancing child safety by reducing the frequency of stop-arm violations begins with swift and effective enforcement. Enforcement should not be limited by bus driver capabilities or the time restraints of each school district or law enforcement agency. A forward-looking model would provide flexibility for smaller districts to work with law enforcement to process violations manually and at the same time allow larger districts the option of third-party involvement to assist with higher numbers of violations and vigorous compliance with the law.

Feasibility of Requiring Home-Side Loading

As a general rule, the research team found that many school districts use home-side loading when possible and are conscientious about every stop made where children must cross the street to load or unload from the bus.

In an effort to evaluate the impact of requiring home-side loading for all stops, the research team worked with a school district to evaluate both an urban and rural route scenario. The existing bus routes were revised to comply with home-side loading and a comparison was made in terms of number of student stops, distance traveled, and student ride time.

The results show that requiring home-side loading for all stops has dramatic effects on routing efficiency (33 more student stops on the urban route and 17 more miles of travel on the rural route) and considerable cost impacts. At a minimum, this requirement resulted in more than $8,000 and $24,000 in additional annual costs for the single urban and rural routes, respectively. At the district level, this had an impact on the district operating costs by a factor of 1.6.

Although a more detailed evaluation across multiple districts study could refine these estimates, home-side loading has the potential to affect the cost per pupil transported significantly without a defined quantifiable benefit to justify these costs.

Looking forward, districts should continue to be encouraged to consider home-side loading as a matter of best practice and discretion and stop short of a specific requirement. The decisions made regarding every bus stop and route should be derived, reviewed, and modified using the local knowledge and resources from the district.

Driver Training Curriculum

Based on review of other state driver manual content, the researchers noted several illustrations that could possibly be used to improve driver comprehension of school bus stop requirements. However, no research has been done to verify the public's understanding or opinion of the illustrations. Including similar illustrations in driver training manuals are suggested as best practices based on the expert opinion of the researchers.

REFERENCES

American Traffic Solution (ATS). "School Bus Safety". http://www.atsol.com/solutions/school-bus-safety. Accessed October 2012.

Demetre, J. D., D. N. Lee, R. Grieve, T. K. Pitcairn, K. Ampofo-Boatneg, and J. A. Thompson. (1993). Young children's learning on road crossing simulations. *British Journal of Educational Psychology*. 63:349-359.

Driver Services Research and Driver Safety Data Analysis. (2012). personal communication, November 13, 2012.

Florida Department of Education (DOE). (2000). School Bus Stop-Arm Violations in Florida: A Follow-Up Study. Center for Urban Transportation Research. July 2000. http://www.cutr.usf.edu/pubs/Stop_arm_viol_follow.pdf.

Gatekeeper Systems, Inc. (GSI). http://www.gatekeeper-systems.com/bus_division/products_07.php. Accessed October 2012.

Hotz, G. A., S. M. Cohn, A. Castelblanco, S. Colsten, M. Thomas, A. Weiss, J. Nelson, and R. Duncan. (2004). WalkSafe: A school-based pedestrian safety intervention program. *Traffic Injury Prevention*. 5:382-389.

Iowa Department of Education (DOE). (2012). 2010-2011 Annual Transportation Data for Iowa Public Schools, personal communication, October 12, 2012.

Iowa Senate File (SF) 2218. http://coolice.legis.iowa.gov/Cool-ICE/default.asp?Category=billinfo&Service=Billbook&frame=1&GA=84&hbill=SF2218

National Association of State Directors of Pupil Transportation Services. (2012). Motorists still endangering children by passing school buses illegally Press release. http://www.nasdpts.org/StopArm/2012/documents/Press%20Release-8-20-12-FINAL.pdf

National Highway Traffic Safety Administration (NHTSA). (2010). *Selecting School Bus Stop Locations: A Guide for School Transportation Professionals*. July 2010. http://www.nhtsa.gov/staticfiles/nti/buses/pdf/SelectingSchoolBusStopLocations.pdf

NHTSA. (2011). School Transportation – Related Crashes. Traffic Safety Facts: 2009 Data. Washington, DC: U.S. Department of Transportation. DOT HS 811-396, Revised March 2011. http://www-nrd.nhtsa.dot.gov/Pubs/811396.pdf.

NHTSA. (2012). Reducing the illegal passing of school buses. http://www.nhtsa.gov/people/injury/buses/2000schoolbus/INDEX.HTM. Accessed October 2012.

National Research Council (NRC). (2002). *The Relative Risks of School Travel: A National Perspective and Guidance for Local Community Risk Assessment —Special Report 269*. Transportation Research Board of the National Academies. Washington DC.

New York State Education Department (NYSED). (2012). Pupil Transportation: Parent Information – School Bus Stops. http://www.p12.nysed.gov/schoolbus/Parents/htm/school_bus_stops.html. Accessed October 2012.

North Carolina (NC) School Bus Safety. (2012). North Carolina Pilot Testing of Bus Stoparm Video Camera Systems. October 2012. http://www.ncbussafety.org/StopArmViolationCamera/index.html.

Rockford Public Schools - Department of Transportation. Rockford, Illinois. http://www.rps205.com/transportation/danger.htm

Schwebel, D. C., and L. A. McClure. (2010). Using virtual reality to train children in safe street-crossing skills. *Injury Prevention*. 16:117-125.

Townsend, J. B. (2011). "Stop! In the Name of the Camera: Reducing School Bus Stop-Arm Violations." *The Huffington Post*. December 13, 2011. http://www.huffingtonpost.com/john-b-townsend-ii/school-bus-cameras_b_1132070.html. Accessed October 2012.

Turner, P. A., and J. Stanley. (2008). *Reducing School Bus Stop-Arm Violations in Texas: Pilot Test Results for the Application and Effectiveness of Digital Video Technology in Identifying School Bus Stop-Arm Violations*. Texas Department of Transportation, Austin, Texas. Texas Transportation Institute. 2008.

University of Minnesota Local Technical Assistance Program (U of M LTAP). (2011). ITS Solutions for School Bus Safety. http://www.mnltap.umn.edu/publications/factsheets/documents/pilot/stlouis.pdf

Yang, J., C. Peek-Asa, G. Cheng, E. Heiden, S. Falb, and M. Ramirez. (2009). Incidence and characteristics of school bus crashes and injuries. *Accident Analysis & Prevention*. 41:2, 336-341.

Center for Transportation Research and Education

School Bus Safety Study – Kadyn's Law

tech transfer summary

Results from this study will assist the Iowa Department of Transportation/Department of Education/Department of Public Safety (DOT/DOE/DPS) in addressing the goals and safety study elements placed within Kadyn's Law.

Background

In 2012, the Iowa legislature passed a bill for an act relating to school bus safety, including providing penalties for failure to obey school bus warning lamps and stop signal arms, providing for a school bus safety study and administrative remedies, and making an appropriation. The bill, referred to as Iowa Senate File (SF) 2218 or "Kadyn's Law," became effective March 16, 2012.

Project Scope

A multiagency committee requested assistance from a team comprised of researchers from both Iowa State University and the University of Iowa in addressing the safety study elements of Kadyn's Law as follows:

- Use of cameras mounted on school buses to enhance the safety of children riding the buses and aid in enforcement of motor vehicle laws pertaining to stop-arm violations
- Feasibility of requiring school children to be picked up and dropped off on the side of the road on which their home is located
- Inclusion of school bus safety as a priority in driver training curriculum

Key findings and recommendations for each study element are included in the final report and also summarized in this document.

Students being let off their school bus on a rural curve

December 2012

RESEARCH PROJECT TITLE
School Bus Safety Study – Kadyn's Law

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Findings and Recommendations

Do Cameras Reduce Stop-Arm Violations?

Stop-arm cameras by themselves are of little value without a supporting process that results in violations for those who break the law. The technology needed to record and process violations varies. However, the technology is becoming much easier to acquire, given that many school districts have already equipped their buses with internal cameras and, therefore, adding an additional camera for stop-arm violations is a logical next step.

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Rear view of a school bus with front and back stop arms in Buffalo, New York

Processing violators is a laborious task for all parties involved. It is currently up to the school bus driver to note each stop-arm violation. The school district must then isolate the images and provide this to the local law enforcement agency. Law enforcement then has to verify and deliver the violation to the motorist.

As noted in the report, North Carolina went through a decade of increased penalties and fines for stop-arm violations, yet little progress was made until they enacted a law that allowed for automation and third-party involvement.

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Looking forward, districts should continue to be encouraged to consider home-side loading as a matter of best practice and discretion and stop short of a specific requirement. The decisions made regarding every bus stop and route should be derived, reviewed, and modified using the local knowledge and resources from the district.

Driver Training Curriculum

Based on review of other state driver manual content, the researchers noted several illustrations that could possibly be used to improve driver comprehension of school bus stop requirements. However, no research has been done to verify the public's understanding or opinion of the illustrations. Including similar illustrations in driver training manuals are suggested as best practices based on the expert opinion of the researchers.

Keep Aware Driving – Youth Need School Safety Act (Kadyn's law) Educational Program

Goal – Foster increased public awareness of motor vehicle laws and safe driving behaviors relating to school bus safety (defined in SF2218)

Objectives

1. Increase awareness of risks to students boarding and exiting school buses, and identify actions motor vehicle drivers, students, parents and bus drivers can take to minimize those risks.
2. Educate novice drivers about school bus safety laws and safe driving behaviors.
3. Reintroduce school bus safety laws and safe driving behaviors to senior drivers.
4. Educate Iowa motor vehicle drivers on the state's bus safety laws and penalties to increase compliance with those laws.
5. Engage school districts in educational program activities.
6. Engage outside businesses and organizations in educational program activities.

Educational Strategies

Strategy	Responsible Agency(ies)/Person	Target Audience	Implementation date/period	Current status
Inclusion of section in Iowa Driver's Manual relating to school bus no passing law	Iowa DOT/David Stutz	Novice drivers and first-time license holders	Ongoing	
Inclusion of at least five questions in Iowa's written driver's license test relating to school buses, including the new drive test app, which will be available in Apple and other app stores for download onto smartphones.	Iowa DOT/David Stutz	Novice drivers and first-time license holders	August 2012	Questions were included in drive test iPad app released in August 2012
Inclusion of a more expansive section on school bus safety in the Iowa DOT's new interactive Iowa Driver's Manual	Iowa DOT/David Stutz	Novice drivers and first-time license holders	Timing of this strategy is contingent on development and release of the new interactive manual.	

Last updated: 12/21/2012

Issue news releases in cooperation with local school districts that are targeted to high incident locations Sample releases: • North Iowa drivers cautioned about passing a stopped school bus • Decorah area drivers cautioned about passing a stopped school bus • Keep our kids safe – do not pass a stopped school bus	Iowa DOT/Dena Gray-Fisher, in coordination with the requesting DOT district	Motor vehicle drivers	Ongoing, as needed	Ongoing; three released issued so far in 2012
Utilize social media (Facebook and Twitter) to post information on school bus safety tips and Iowa laws	Iowa DOT and Iowa DOE will post messages	Motor vehicle drivers, parents and students	Periodically throughout the school year	Ongoing
Issue a news release offering safety tips for motor vehicle drivers, students and parents at the start of the school year Sample release: • School bus safety – tips for your kids	Iowa DOT and DOE joint release	Motor vehicle drivers, parents and students	August or September 2012	Completed
Expand content offered on the Iowa DOT's bus safety information website (http://www.iowadot.gov/mvd/ods/IowaSchoolBusLaws.html) , and establish links to the website from the Department of Education's and Department of Public Safety's websites • Add revised DOE brochure • Provide links to NHTSA resources • Embed bus safety videos presently available on YouTube • Provide links to activity/coloring books for students • Provide a link to Kadyn's law website	Iowa DOT, with information received from partnering agencies	All	Additional content will be added prior to start of school 2012, then new content added when it becomes available	A comprehensive new site was developed by the DOT

Redesign and distribute "When you see a school bus" brochure and add an electronic version to the DOE website.	Iowa DOE	Motor vehicle drivers and parents	Issued redesigned publication in August and mentioned on Facebook and Twitter; and put on DOE homepage September Issue newsletter to school admin. and educators	Done
Utilize, broadly new no passing school bus graphic images created by the Iowa DOT	All agencies	All	Ongoing Annual training for school bus drivers in August 2012 utilized images	Ongoing
Incorporate a section on school bus safety in the existing driving skills refresher course presented by Iowa DOT driver's license supervisors to seniors drivers and young drivers	Iowa DOT/Office of Driver Services	Senior drivers and young drivers	Fall 2012	Done
Provide bus safety information to Iowa's coordinators of AARP's 55ALIVE Driver Safety Program, the nation's largest refresher course for drivers age 55 and older to help sharpen their driving skills.	Iowa DOT/Office of Driver Services	Senior drivers	Ongoing	Ongoing
Establish links between Iowa DOT's school bus safety website and the Safe Routes to School website	Iowa DOT/Office of Public Affairs	Participants and persons interested in the Safe Routes to School program	June 2012	Done

Encourage media to participate in a ride-along in school buses during a stepped up enforcement week while enforcement in a local school district is underway	Iowa DPS	Media Motorists Bus drivers School districts	Central Iowa Traffic Safety Group (October 2012) that could be modeled in other parts of the state	
Statewide school bus tour	Iowa DOE	Legislators Media	Needs further exploration	
Create a video – school bus safety	Iowa DOE or working with a school district to produce video	Students Parents	Needs further exploration	
Announce completion of Senate File 2218 study and key findings	Joint announcement with ISU, Univ. of Iowa and partnering state agencies IGOV may need to take the lead. coordinated with legislative interests	General public and policy leaders	Draft report end of October Final report December 2012	Completed
Participate in National Association for Pupil Transportation's (NAPT) **2013** National School Bus Safety Week- http://archive.austinisd.org/schools/docs/bus_National_School_Bus_Safety_Week.pdf) -by: • The Iowa Department of Education will sponsor the 2013 National School Bus Safety Poster Contest, allowing any student in a public, parochial or other private elementary or middle school in Iowa to submit artwork to DOE for judging. Posters must be received by Oct. 1, 2013. Posters can be drawn anytime between September 2012 and September 2013. The top prize for winning the poster contest is $500. (see Pennsylvania	DOE/Max Christensen (with some assistance from others) Co-sponsor IPTA DOT will post information related to the contest and School Bus Safety week on its Facebook site and school bus safety site	Drivers Students Parents Schools	School Bus Safety Week is the third week in October each year. The 2013 is scheduled for Oct. 13-19, 2013. Due to the timing of the Kadyn's Law educational campaign, the plan is for Iowa to participate in the 2013 contest activities.	

model) • Advance to the national level and promote publically selection of the state winners, first-place only, in the following categories: o Division #1 - Grades K-2 o Division #2 - Grades 3-5 o Division #3 - Grade 6-8 o Division #4 - Special Education Division #5 - CAD (Computer Aided Drawing) • Share the national Poster Contest winning poster designs on DOE and DOT Facebook sites. • Issue news releases announcing 2012, 2013 and 2014 School Bus Safety Week, outline extent of illegal passing problem and offer safety tips. • Submit a letter to the editor of the Des Moines Register outlining safety problem and importance of protecting the safety of school children. • During School Bus Safety Week, ask schools to display school buses at shopping centers or supermarkets with drivers available to answer questions or hand out materials about school bus safety. • Seek a governor's proclamation with public signing where Kadyn's family is in attendance, as well as the bill's promoters. • Encourage school districts to publish a short article in their district newsletter or website (provide sample content). • Publish information about National School Bus Safety Week on the Iowa DOT's school bus safety website			General educational information will be released each year during this period.	

Provide no passing school bus graphic images to school transportation directors to share with their bus drivers (http://www.iowadot.gov/mvd/ods/IowaSchoolBusLaws.html)	DOE	Bus drivers	August 2012	Completed
Establish and promote a Storify site for published information about school bus safety Site is located at: http://storify.com/Maverick/iowa-school-bus-safety Slideshow version: http://storify.com/Maverick/iowa-school-bus-safety/slideshow	Iowa DOT/Office of Public Affairs	All	May 2012 – site established Promoted – will be mentioned in the school start-up news release in August/Sept. 2012	Ongoing
Utilize Kadyn's law branding/acronym, where appropriate, within campaign efforts (KADYN: **K**eep **A**ware **D**riving **Y**outh **N**eed School Safety)	All agencies	All	Ongoing	Ongoing
Iowa DOT rulemaking for driver's license sanctions -- Issue a news release about driver's license sanctions and penalties when Iowa Transportation Commission takes action on Aug. 14, 2012.	Iowa DOT	All drivers	New admin. rules effective August 15, 2012	Completed